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Design of Herringbone Gears

Methods of Cutting—Involute and Cycloidal Tooth Forms—Determination of Strength and Wear Factors—Care of Herringbone Gears

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THE rapid progress in the use of cut herringbone gears calls for more general information among mill engineers on the principles and practical points of their design. Nearly all writers on the subject, excepting the recent work of the Gear Manufacturers Association, have had a particular system or type of gear to advocate. This has resulted in a great deal of confusion and lack of general knowledge. Many times a gear has come to our attention which might have been produced much more cheaply if the designer had been familiar with the practice and methods for cutting such gears. It is the intention of this article to place such information before the reader in a clear, concise manner and to enlarge somewhat on theory.

To avoid confusion, let it be clearly understood that in its elements a herringbone gear is similar to a spur gear. Both have rolling action in the same plane, a plane normal to the axes of the gears; both have the same circumferential pitch for the same pitch diameter and the same number of teeth. A good tooth form for the spur gear is generally also a good tooth form for the herringbone gear, although, as will be shown later, the exact reproduction of the correct tooth curve is vastly more essential for the best operation of the herringbone gear.

In earlier days double or triple staggered spur gears were used, thereby obtaining a strong, heavy tooth with a comparatively smooth action. If this principle is now carried to its limit we obtain a helical gear. The

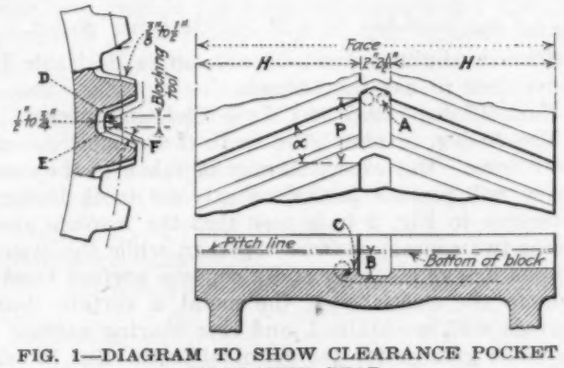


FIG. 1—DIAGRAM TO SHOW CLEARANCE POCKET IN PLANED GEAR

tooth profile on one side of the gear has been twisted ahead so as to occupy the former position of the tooth profile of the next tooth. Beyond this amount of twist nothing is gained so far as continuity of action is concerned. The herringbone gear is virtually two helical gears placed alongside each other, one having a right-hand helix and the other a left-hand helix.

In helical or herringbone gears it requires a right-hand helix to mesh with a left-hand helix. Therefore, if the ends of the pinion shaft or the hubs of the gear are not symmetrical, care must be exercised that the apex of the "V" be made in the proper direction. It

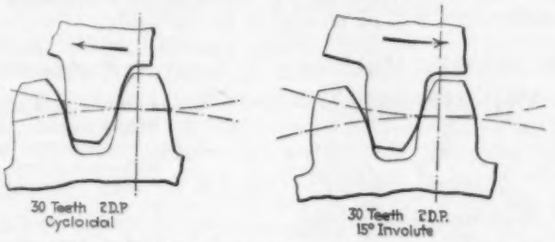


FIG. 2—OUTLINE OF INVOLUTE AND CYCLOIDAL TEETH

is customary to run molded herringbone gears with the apex of the "V" leading. This is not necessary with cut herringbone gears. They will run equally well in both directions but sometimes to prevent sideways splash of oil it is advantageous to run them in the opposite direction.

A knowledge of the different methods of cutting herringbone gears is essential, as that system of cutting or type of gear may then be selected which is the most economical for the case under consideration. Such gears are usually applied in the following cases:

I. Slow speeds and very heavy loads where strength and absence of shocks are of prime importance.
II. Smooth and noiseless operation.
III. Extremely high speeds.
IV. Very high gear ratios.

In the first class are all heavy rolling mill pinions. These may have up to 8 in. circular pitch. The smoother action resulting from the use of these pinions tends greatly to reduce breakage of all the machinery driven through them. The second class comprises nearly all cases of gear drives, such as mill drives, pump drives, mine hoist drives, and machine tool drives. In the latter application they are found to be a great aid in overcoming chatter in the machine. They have thus been applied particularly to planer drives. Spur gears become noisy at pitch speeds of 1,200 ft. per minute and should not be used at pitch speeds greater than 2,000 ft. per minute, if avoidable. The use of herringbone gears will then be found preferable. If a herringbone pinion is desired for the first reduction in connection with a motor, it should never be mounted on the armature shaft, but on an independent shaft connected to the motor through a flexible coupling. The other mounting may cause destructive end whip-

ping of the armature if the load should happen to set up a suitable period of vibration.

The third class consists mainly of turbine drives. High pitch speeds, 3,000 to 5,000 ft. per minute, should not be attempted except with generated gear teeth. The slight inaccuracies due to any other method will render them very noisy and inefficient. Generated herringbone gears have been run at 10,000 ft. per minute. A good oil spray should always be provided at the point where the teeth enter into mesh.

The pitch of herringbone gears may always be made finer than for spur gears for equivalent strength. It is thus possible to obtain smaller pinions, and consequently higher gear ratios. Also, because of the continuous action of such gears, it is possible to use a fewer number of teeth in the pinion. Such pinions have now been made to work successfully with only one tooth.

The preceding classification largely determines the method to be followed in the cutting of the gears. With particular reference to the method of machining the classification will be as shown in the table.

Method of Machining	Type of Gear
A. Planing by templet principle.	1. for slow speed and heavy loads. 2. for smooth and noiseless operation. 4. for high gear ratios.
B. Hobbing—Generating.	2. for smooth and noiseless operation. 3. for high pitch speed. 4. for high gear ratios.
C. End Milling.	2. for smooth and noiseless operation. 4. for high gear ratios.
D. Shaping—Generating.	2. for smooth and noiseless operation. 3. for high pitch speeds. 4. for high gear ratios.

The different methods with their specific characteristics will now be considered in this order.

Usually all gears having pitches greater than 1 D.P. are planed in gear planers working on the templet principle. Planing is an economical method for removing great quantities of metal. The tools are heavy, rigid, and inexpensive, and need therefore not be used with much consideration for their safety. But as the pitch becomes smaller, about 2.5 in. C.P., the method ceases to be economical.

Planing by Templet Principle

There are generally few limitations to planing, fewer than for any other method. The machines are broadly divided into two classes, those carrying one tool and those carrying two tools. Either class requires a clearance pocket at the center of the face 2 in. to 2.5 in. wide. In order to make the casting equally adaptable for both classes, this pocket should be made as shown in Fig. 1. In case the pinion is made of forge steel the pockets may be drilled as indicated at *a*, after which the block is chipped out. For the best work this pocket should then be milled so as to leave no sharp corners. A pinion of small pitch diameter and wide face will have its stiffness greatly augmented by the retention of this bridge. But for cast-steel gears or pinions with less than 4 in. C.P. the bridge becomes so thin that it is a source of weakness rather than of strength.

The stock *F*, left for finishing, should not be less than $\frac{1}{2}$ in. and sometimes as much as $\frac{3}{4}$ in. to take care of uneven shrinkage of the casting. If the "block" is carried down, as indicated at *D*, there are apt to be "draws" formed at the root and the sand will burn in, thus making it difficult to clean the casting. It is better, therefore, to "block" as indicated at *E*, especially

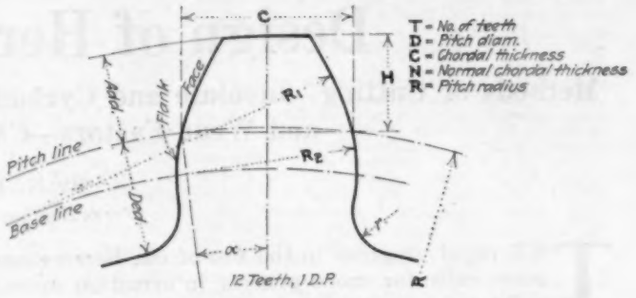


FIG. 3—DIAGRAM FOR CALCULATING CHORDAL THICKNESS

since it will not take any more time for planing. For small pitches the depth *B* of the pocket is a very bad feature in the mold. The hot steel rising in the mold forms eddies at *C*, forming blowholes and dirt which seldom become visible until the gear is rough planed. It is well, therefore, simply to blank all gears with pitches up to 4 in. inclusive, and to cut a groove from the solid to a depth of $\frac{1}{16}$ in. below the root of the tooth.

The helix angle should not be less than such that

$$\tan \alpha = \frac{P}{H}$$

as shown in Fig. 1.

But it should, as a rule, not exceed 23 deg., which is the standard for hobbed gears. Any greater helix angle will cause the normal section of the tooth to become rather thin. Mill pinions, due to their hard service, may be thrown out of alignment. The load may therefore at some instant be thrown entirely on one end of the tooth, breaking out that end because of the weakened normal section.

The face of the gear will be found to be from 6 to 10 times the circular pitch. In our practice a 17-deg. helix angle has been adopted as standard for mill drives. For this case the minimum face becomes

$$F_{min.} = 6.541 \times \text{C.P.} + \text{clearance pocket.}$$

Since a slight amount of overlap is desirable it is convenient to use the formula

$$F_{min.}\,(17 \text{ deg.}) = 7 \times \text{C.P.} + \text{Clearance pocket} \quad (1)$$

The 20-deg. involute stub tooth is the most desirable tooth form. But exception may be taken in the case of heavy mill pinions taking an extreme tooth load. By reference to Fig. 2 it is seen that the involute system places two convex surfaces together, while the cycloidal system brings a convex and a concave surface together. Due to the elasticity of the metal, a certain bearing surface will be obtained, and this bearing surface will be much greater for the cycloidal tooth. But in selecting a cycloidal tooth form regard should be had for the fact that cycloidal gears run correctly only at fixed center distances. Their use where bearing wear cannot be kept within reasonable limits may therefore be inadvisable.

The tooth profile and tooth thickness dimensions are required for the pattern and for cutting the gear and should therefore be given fully on the drawing. The former dimensions may be taken from a good odontograph table or may be determined by an actual

layout. In involute gears there can be no action below the base line and the part of the tooth which extends below is ordinarily made with a radial flank. But this method sometimes leaves a tooth which requires a slight additional rounding at the base line to satisfy appearance. It will be found better to continue the flank radius and to draw the radial line tangent to this arc. The tooth should then be joined to the root circle with a fillet radius equal to about $\frac{1}{10}$ of the circular pitch.

In order to calculate the chordal thickness of the tooth it is convenient to consider the gear as having no backlash. Then

$$\alpha = \frac{90}{T}$$

as shown in Fig. 3 and

$$C = D \sin \alpha. \quad (2)$$

Similarly,

$$H = \text{Addendum} + R(1 - \cos \alpha). \quad (3)$$

The dimension H is used for the depth of the gage, but the width of the gage must be made to suit the normal tooth section. Disregarding the slight change in curvature on the normal section, we have

$$N = C \times \cos(\text{helix angle}). \quad (4)$$

The gage being made to this dimension, the amount of backlash will be determined by the shake of the gage. This amount depends entirely upon the degree of accuracy to which the gears are planed. The friction and inertia in indexing large, heavy gears makes it unsafe to rely entirely on the index wheel, as the resulting errors in tooth spacing may be excessive. Consequently, it is well to finish the upper side of the teeth, after which the variation from the true tooth spacing is gaged. In our practice not more than 0.005 in. variation in the spacing is permitted, and several teeth may have to be replaned to come within this limit. Since it is possible that two such teeth will come in mesh the minimum backlash is 0.010 in., and the total backlash may be given as

$$\text{Backlash} = 0.010 + 0.001 \times \text{C.P.} \quad (5)$$

Hobbing Herringbone Gears

Nearly all the smaller gears used in mill work may be cut by the hobbing process. Hobbing is a very economical method for gears not exceeding 1 D.P., and such gears should therefore preferably be designed with this method in view. The method employs a hob having an axial section similar to that of a rack, and this hob will automatically generate any gear of a similar pitch. Due to the expensive hob equipment, it has been necessary to standardize the tooth elements. We find, therefore, the following standards fairly well adopted:

Tooth form = 20 deg. involute,
Helix angle = 23 deg.,
Pitch = diametral, with 1 D.P. as maximum,

$$\text{Addendum} = \frac{0.8}{\text{D.P.}}, \quad (6)$$

$$\text{Dedendum} = \frac{1}{\text{D.P.}}, \quad (7)$$

$$\text{Minimum face about } 6 \times \text{C.P.} \quad (8)$$

To avoid interference, and partly to give freer cutting action to the hob, the outside diameter for pinions of 17 teeth or less is given a slight increase.

$$\text{Enlargement} = \frac{2(1 - 0.0585N)}{\text{D.P.}},$$

where N = number of teeth in pinion. (9)

Usually the gear blank is reduced a corresponding amount, thus maintaining the correct center distance. Regardless of this change in the blank diameter, the tooth is cut to the standard depth. The gear requires a clearance space in the center of the blank approximately equal to the circular pitch and of a depth slightly greater than the addendum of the tooth. (These standards were published on pages 329 and 589, Vol. 56 of *American Machinist*.)

Hobs are made with single or with multiple threads. If multiple threaded hobs are used, it may be advisable to have a number of teeth in the gear not divisible by the number of threads in the hob. A distorted hob tooth will then not be able to cut continuously in the same tooth space. The resulting tooth spacing will be more uniform and the gear action correspondingly more smooth and noiseless. As an example, a pinion of 13 or 17 teeth will run very well with gears of 101, 103, or 107 teeth.

End Milling and Shaping

End milling, though much used on the continent, has found little favor in this country. The end mill is a small tool, incapable of standing up against heavy cuts, or of carrying the heat incidental to taking such cuts. The maximum pitch which so far is being milled is about 5 in. circular, and the mean diameter of the mill is therefore only 2½ in. The shape of the mill must be made to suit the normal section of the tooth space. Now, this shape varies for every different pitch, and for every different number of teeth in that pitch. It will require a series of 25 end mills of each pitch to get a fairly close approximation to the correct tooth curve.

One outstanding advantage of the end milling process is that it is able to produce a tooth that is seemingly continuous across the face of the gear. There can, however, be no tooth action at the point of reversal of the helix angle and the radius is, therefore, relieved to avoid interference. Another advantage, which must be shared with planed gears, is the ability to retain a shroud on the faces of the pinions.

Shaping by the molding-generating method or by the shaping-generating method is only used for smaller gears. One machine of the former type, not in use in this country, is able to cut a gear having the teeth meet in a sharp apex. Another machine of the latter type is now being used for gears in machine tool construction. These gears are not being built to a universal standard, and will therefore not be covered in this article.

Standard Tooth Proportions

The involute curve has many advantages over any other tooth curve. It may be generated by a rack with straight sides, and this generated tooth curve may also as readily be ground if required. The 20 deg. pressure angle has now been universally adopted for all classes of work. Since hobbing is the standard process for gears up to 1¼ D.P. or 1 D.P., gears of these pitches will have tooth standards as previously given. Gears with pitches greater than these are principally planed, and it is therefore this class which remains to be considered. Since the heavier pitches are always given in terms of circular pitch, the tooth standards should be given on that basis.

$\frac{0.8}{\text{D.P.}} = 0.2546$ C.P., and $\frac{1}{\text{D.P.}} = 0.3183$ C.P.

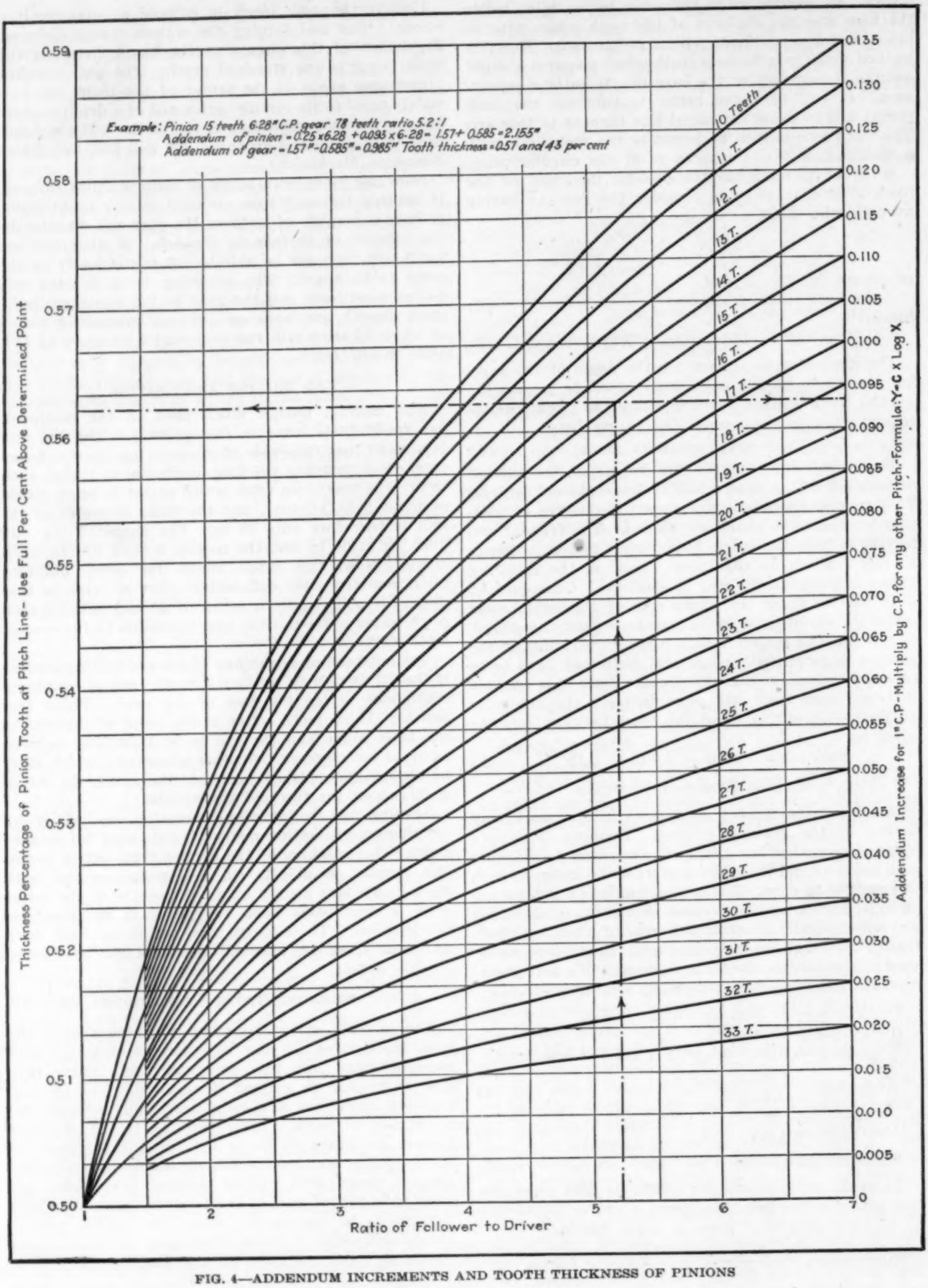

Example: Pinion 15 teeth 6.28" C.P. gear 78 teeth ratio 5.2:1
Addendum of pinion = 0.25 x 6.28 + 0.093 x 6.28 = 1.57 + 0.585 = 2.155"
Addendum of gear = 1.57" - 0.585" = 0.985" Tooth thickness = 0.57 and 43 per cent
Thickness Percentage of Pinion Tooth at Pitch Line - Use Full Per Cent Above Determined Point
Addendum Increase for 1" C.P. - Multiply by C.P. for any other Pitch. - Formula: Y = C x Log X
Ratio of Follower to Driver
10 Teeth
11 T.
12 T.
13 T.
14 T.
15 T.
16 T.
17 T.
18 T.
19 T.
20 T.
21 T.
22 T.
23 T.
24 T.
25 T.
26 T.
27 T.
28 T.
29 T.
30 T.
31 T.
32 T.
33 T.

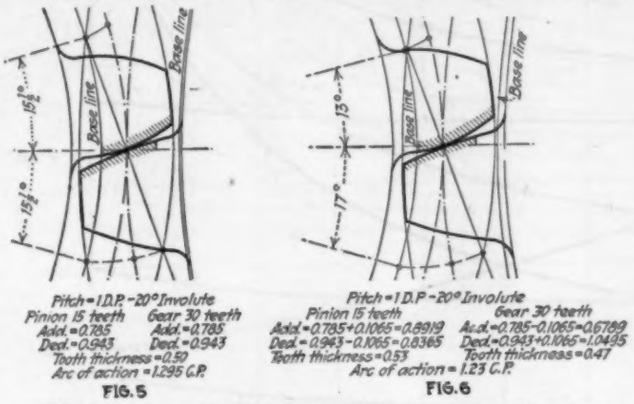
FIG. 4—ADDENDUM INCREMENTS AND TOOTH THICKNESS OF PINIONS

For the sake of simplicity we shall change these to the commonly accepted standards

$$\text{Addendum} = 0.25 \text{ C.P.} \quad (10)$$

$$\text{Dedendum} = 0.30 \text{ C.P.} \quad (11)$$

In heavy gearing there is no need of an interchangeable system. The freedom from restrictions of the "planing by templet process" should therefore be taken into account. It is well known that the tooth action is more destructive on the arc of approach than



FIGS. 5 AND 6—ACTIONS OF NORMAL AND MODIFIED TEETH CONTRASTED

on the arc of recess. The remedy is to increase the addendum of the pinion, as was done for hobbed gears. But the method used for hobbed gears if applied to a set of three high mill pinions of 10 and 17 teeth respectively would give very bad tooth action, as the dedendum of the 17 tooth pinion would be entirely too deep. Any system, to be workable, must take account of the number of teeth in the pinion, the gear ratio, the position of the base circles in relation to the action of the gears, and the arc of action. The arc of action should be greater than the circular pitch, preferably about 1¼ C.P. Appearance demands that the tooth thicknesses be made approximately equal on the apparent pitch diameters, and the resulting pinion tooth will be much stronger than would otherwise be the case. The amount which the pinion addendum should be increased is rather arbitrary, but it has a three-fold purpose:

(1) To eliminate undercut of the teeth;

(2) To insure contact along the entire face of the gear addenda;

(3) To reduce the arc of approach and increase the arc of recess.

As long as the pinion and the gear each have less than 30 teeth the conditions are fulfilled by the first two factors. The gears may therefore be so proportioned that their base circles are equidistant from their respective root circles, and a straight line formula will satisfy the amount of addendum increase. The necessity for the first two conditions disappears, however, as the pinion gets a greater number of teeth. Now, for gear ratios of one to one interchangeability of position is generally required. We find then by trial that the addendum increment is satisfactorily governed by the formula, $y = C \times \log X$, in which y = addendum increment and X = gear ratio. The constant C is determined by trial. Ten teeth may safely be assumed as being the minimum. For hobbed gears the addendum increment would in that case be 0.420 in. for a pitch of 1 D.P., or 0.1337 in. per inch of pitch. For convenience in plotting the curve we will use 0.135 in., making the increment 0.005 in. less for each additional tooth in the pinion. The results are plotted in Fig. 4, which is self-explanatory. A contrasting example is given in Figs. 5 and 6, in which the shaded portions represent the parts acting upon each other. It is seen that the arc of approach has been decreased with a consequent improvement in the relative sliding action. Likewise, the arc of recess has been increased. Due to the small ratio of these gears the improvement is not as noticeable as it would be for a greater gear ratio. A 15-tooth, 1 D.P. piston meshing with a rack is shown in Fig. 7. Here the relative slip has been nearly eliminated on the angle of approach, and the tooth has the stubby profile giving maximum strength.

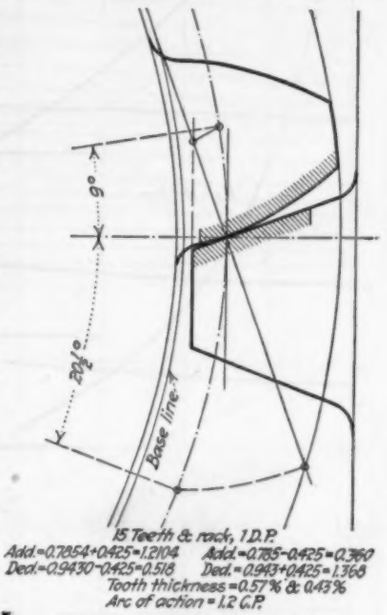


FIG. 7—MODIFIED RACK AND PINION

The strength of herringbone gears is affected by several conditions which are beyond the control of the designer, and which are dependent mainly on the accuracy of the teeth and the alignment of the gears in operation. There are, however, several other conditions which may be determined to a nicety. The formula for strength of gear teeth according to Lewis is

$$W = SPFYK,$$

in which W = load, S = safe stress, P = circular pitch, F = face, Y = tooth form constant, and K = speed factor. Evidently S remains unchanged. Likewise, remembering that the rolling action is in the same plane as for a spur gear, P remains unaffected. The tooth load W, acting tangentially to the pitch line, is accompanied by the side thrust T, giving a resultant force N normal to the helix angle. Now,

$N = \frac{W}{\cos \alpha}$, and the gear face measured along the helix $= \frac{h}{\cos \alpha}$

Therefore, the load per inch of face $= \frac{W}{\cos \alpha} \div \frac{h}{\cos \alpha}$, $= \frac{W}{h}$, which shows that the face F is also unaffected. (See Fig. 8.)

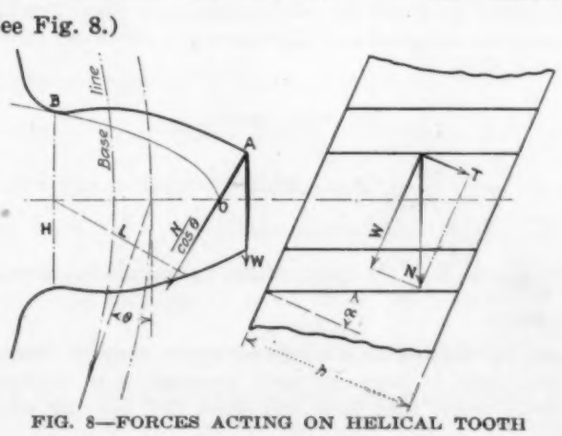
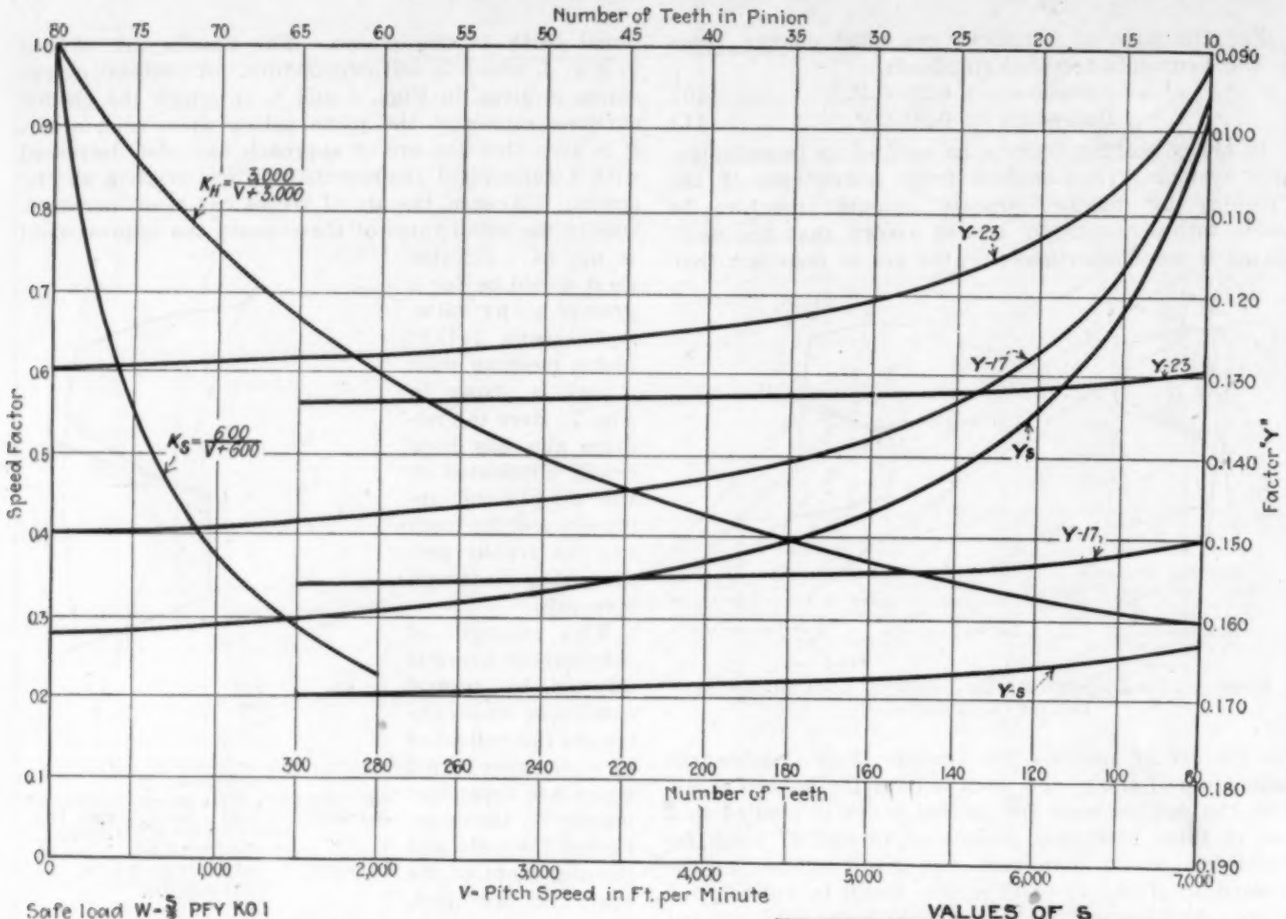


FIG. 8—FORCES ACTING ON HELICAL TOOTH



Safe load $W = \frac{S}{2} P F Y K O I$

S = Safe stress at no speed—see table
P = Circular pitch
F = Total overall face of gear in inches
Ys = Tooth factor for spur gear
Y17 = Tooth factor for 17 deg. herringbone gears
Y23 = Tooth factor for 23 deg. herringbone gears
K_S = Speed factor for spur gears
K_H = Speed factor for herringbone gears
O = Lubricant factor
1.0 for well oiled gears
0.6 to 0.8 for grease lubrication
I = Addendum increment factor—see S-197
= (2 x tooth thickness percentage)^2 thus $(2 \times .56)^2 = 1.254$

Example: Pin. 15 T.-4" P.-30° F.-17 deg. helix-50 C.F.St.-1830 ft. per min.-gear 93 T.

$W = 12,500 \times 4 \times 3.0 \times .0165 \times .62 \times 1 \times 1.142 = 140.000$ lb., $\frac{140,000 \times 1830}{33,000} = 7,750$ hp.

VALUES OF S

METAL	S	ULT. T. ST.
Nickel steel heat treated	30,000	120,000
Forge " 50 C	25,000	100,000
Forge " 30 C	20,000	80,000
Cast " 50 C	20,000	80,000
Cast " 40 C	17,500	70,000
Cast " 30 C	15,000	60,000
Cast iron	10,000	32,000
Cast "	8,000	24,000
Bronze 88-10-2	8,000	30,000
Rawhide	5,000	
Fabric	5,000	

FIG. 9—STRENGTH OF CUT SPUR AND HERRINGBONE GEARS

The speed factor K depends entirely on the accuracy of the teeth. If we assume that spur gears become noisy at 1,200 ft. per minute, ordinary planed or end milled gears at 3,000 ft. per minute, and closely generated gears at 6,000 ft. per minute, we may further assume that the constant K is identical for these cases. We have then,

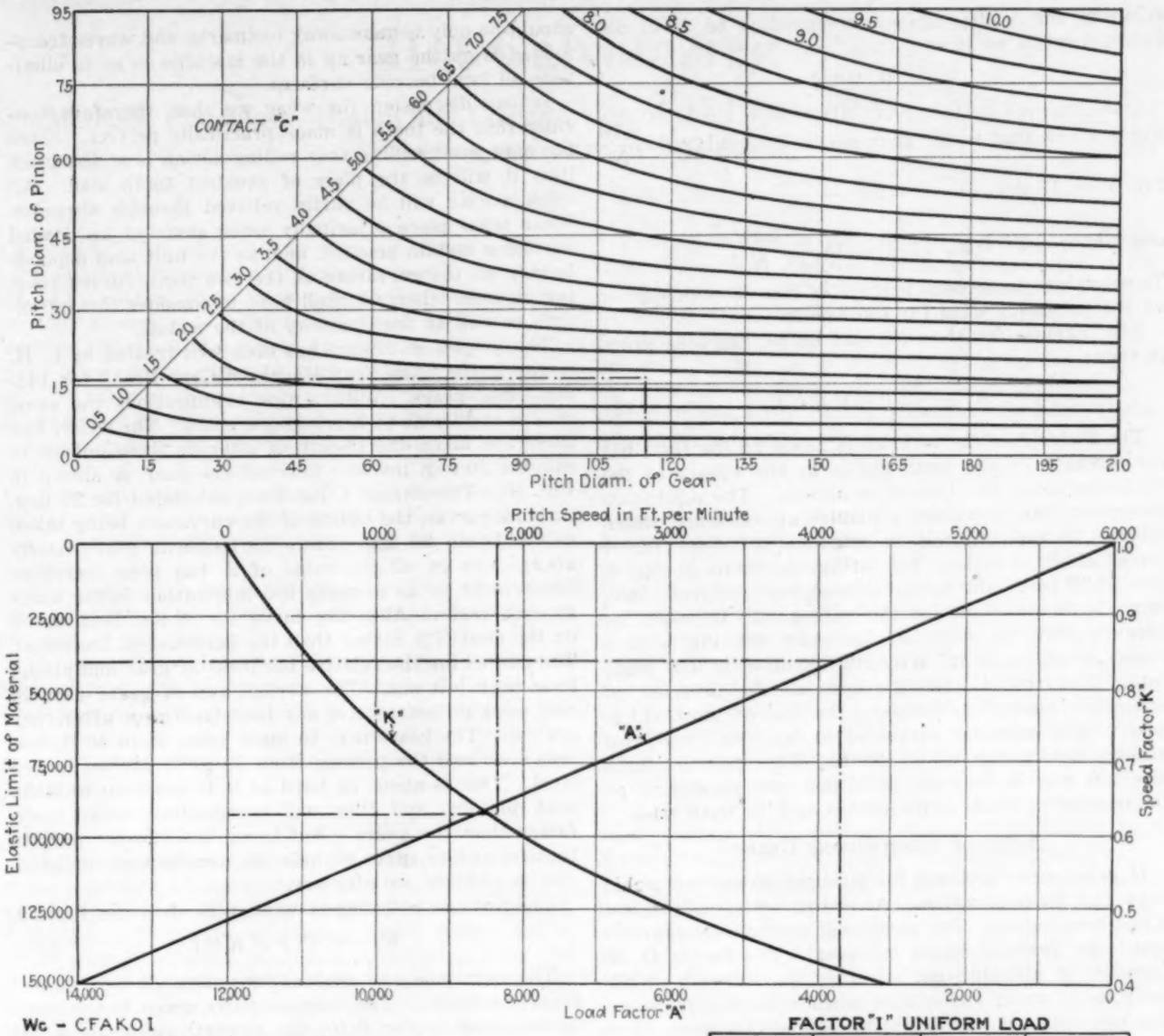
$$K_s = \frac{600}{V + 600} \text{ for spur gears;}$$

$$K_o = \frac{1,500}{V + 1,500} \text{ for ordinary planed or end milled gears;}$$

$$K_g = \frac{3,000}{V + 3,000} \text{ for closely generated herringbone gears.}$$

Now, by painstaking methods, gears may be planed so accurately as regards tooth spacing, true involute, and helix angle that they will show full bearing when run together. For such gears the constant Kg may well be used to the limit of about 3,500 ft. per minute.

The values for the constant Y are not readily solved. In the Lewis method for spur gear teeth it is assumed that a force $\frac{W}{\cos \theta}$, passes through the outer edge of the tooth. Commonly this assumption is incorrect for herringbone gears, in which the load is always concentrated nearer to the pitch line. Observation shows that the wear is usually greatest from the pitch line and out towards the end of the tooth. If we therefore assume that the maximum load occurs at a point half way out the face of the tooth, we shall have shortened the arm L, Fig. 8, about 25 per cent. But the loss of tooth due to the clearance groove is about 17 per cent, leaving 8 per cent still to be considered. The danger from misalignment is a very uncertain element, and is, of course, greater because of the greater ratio of face to pitch. On the other hand, such gears usually receive



Wc = CFAKOI
Wc = Safe load for wear or crushing
C = Contact factor from curve
F = Active face of gear
A = Load factor from curve
K = Speed factor from curve
O = Lubrication factor 1.0 for gears running in oil 0.8-0.62 for grease Lubrication
I = Service factor 1.0 for 10 hrs. per day for 2 years and from table for other periods

Example: Pin. 15 T. 4" P. 30° F. 50 C.-F.S.-1830 ft./min. el. limit = 40,000 - service 1 Yr. cont. - gear 93 T.
Wc = 2.8 x 27.5 x 3.700 x 0.625 x 1 x 0.75 = 134,000 lb.

FACTOR "I" UNIFORM LOAD

SERVICE	CONTINUOUS	10 HRS. DAILY	5 HRS. DAILY
3 Months	3.00	8.00	18.00
6 "	1.50	4.00	9.00
9 "	1.00	2.67	6.00
1 Year	0.75	2.00	4.50
2 "	0.38	1.00	2.25
3 "	0.25	0.67	1.50
4 "	0.19	0.50	1.13
5 "	0.15	0.40	0.90
6 "	0.13	0.33	0.75
7 "	0.11	0.29	0.65
8 "	0.10	0.25	0.56
9 "	0.09	0.22	0.50
10 "	0.08	0.20	0.45

FIG. 10—WEAR OF SPUR AND HERRINGBONE GEARS. CLASSIFICATION OF GEAR CUTTING METHODS

better attention. If we therefore charge the remaining 8 per cent to this factor we shall have simplified the calculations in that the face is to be taken as the total overall face. The layouts for *Y* will therefore be made by the method previously mentioned. But since the forces are acting normal to the tooth it will be necessary to use the normal tooth section for the determinations. Using the formulas developed by A. B. Cox on page 104, Vol. 56 of *American Machinist*, we find that the pitch diameter for the normal section $= D \sec^2 \alpha$. The tooth thickness $= 0.5 \cos \alpha$, and the pressure angle is altered so that

$$\tan \theta = \frac{\tan \theta'}{\sec \alpha}.$$

The force $\frac{N}{\cos \theta}$ is drawn normal to the involute at *A*, and the parabola constructed from *O* tangent to the tooth flank indicates *B* as the point of weakness. The moment tending to break the tooth is therefore $\frac{NL}{\cos \theta}$ with the section along line *H* resisting breakage. Sub-

stituting for N the values corresponding to W in the Lewis formula we have

$$Y = \frac{H^3 \cos \theta}{6\ PL}.$$

For $a = O$, that is for spur gears, $Y = 0.172 - \frac{0.76}{N}$

for $a = 17$ deg., $Y = 0.158 - \frac{0.62}{N}$

and for $a = 23$ deg., $Y = 0.135 - \frac{0.44}{N}$.

These values have been plotted in Fig. 9, which gives all the necessary data for the calculations.

The formula for the safe load on herringbone gears is then:

$$W = \frac{S}{2} P F Y K O I \qquad (12)$$

The factor I in the formula is based on the fact that the strength of the tooth varies as the square of the thickness along the line of weakness. The addendum increment has, however, a disturbing influence which renders it very difficult to establish a correct factor for all different ratios. But within the limits of Fig. 4, that is 33 teeth, the factor is practically correct. Any error is in all cases on the safe side. It might be thought that the teeth in the gear meshing with a pinion would have its strength impaired at the same rate. But this is not the case as the decrease of addendum more than balances the loss of tooth thickness. It is sufficient therefore to consider I only for pinions having up to 33 teeth. The gain in tooth strength may be as high as 30 per cent, depending on the number of teeth in the pinion and the gear ratio.

Wear of Herringbone Gears

If gears were designed for strength alone they would soon fail from abrasion. Accordingly the safe stress S has been halved. The result will very closely approximate any formula based on wear. The factor O, in formula 12, although not affecting the strength of the teeth, is of great importance when wear is considered. For most cases it is sufficient to calculate the gears from formula 12. But if we want to be more careful, we shall have to approach the subject from an entirely different angle.

Herringbone gears, having correct involute curves, will bear along diagonal lines across the tooth. These lines will travel across the tooth from one end to the other. If the helix angle is such as to advance one tooth there will be one diagonal line passing clear across the tooth. If the advance of the helix angle is in multiples of one tooth there will be a corresponding series of shorter lines. But the total length of bearing line is the same in each case and will not vary much in extent from the straight bearing line of a spur gear.

Should the gear not have true involute teeth the bearing lines would be very much shortened, giving bearing close to the pitch line only. The consequent bearing pressure will then be great enough to crush the material and the result is a deep groove along the pitch line on both gear and pinion. Such conditions may be partly relieved by "running in" under light load. But the amount of "running in" should be moderate. If the gears do not show a fair bearing across the teeth after a few hours run it is due to the helix angles not meshing properly. Any great amount of "running in" tends to destroy the proper tooth profile and is therefore harmful. The object of "running in" should be only to take away toolmarks and waves transmitted from the gearing in the machine so as to eliminate all local bearing surfaces.

In our discussion for wear we shall therefore consider that the tooth is made practically perfect. Since the only point having true rolling action is at the pitch line, it will be the place of greatest tooth load. All other points will be partly relieved through abrasion. Wear takes place principally when surfaces are loaded beyond a certain amount, and, as the unit load depends largely on the curvature of the two tooth curves bearing on each other, we shall have to consider this curvature as well as the elasticity of the metals.

The subject of contact has been well treated by C. H. Logue in the "American Machinist Gear Book" for 14½-deg. spur gears. With a few modifications the same data is applicable to herringbone gears. The writer has therefore taken the liberty of altering these curves to suit the 20-deg. involute herringbone gear, as shown in Fig. 10. The contact C has been calculated for 20 deg. involute curves, the radius of the curvature being taken as 0.5 D sin 20 deg. Since herringbone gears nearly always run in oil the value of A has been increased 50 per cent so as to make the lubrication factor unity in such cases. Also, the curve for A has been based on the elasticity rather than the hardness of the metal. The curves for the relative hardness of gear and pinion have been left out. The normal run of gears used in mill work do not receive any heat treatment after they are cut. The gears may be made from 30 to 40 carbon cast steel and the pinions from 50 to 60 carbon forged steel. This is about as hard as it is practical to make such pinions, and they will consequently wear much faster than the gears. But being the cheaper part to replace, and as spare pinions are usually kept on hand, this is entirely satisfactory.

The formula will then be written as shown in Fig. 10,

$$Wc = C F A K O I \qquad (13)$$

The notations and explanations may all be obtained from the figure. The example there given is the same as was used in Fig. 9 for the strength calculations. It will be noticed that the agreement is fairly close. We shall have to accept the values of the service factor I until better experimental data is obtained.

Conclusion

The technical press has recently shown an intense interest in gears of all kinds. But much is yet to be learned, especially of herringbone gears. Where, in earlier days, such gears were made to ample dimensions, greater competition and efficiency will now demand a much smaller gear for the same capacity, and this can only be done with great attention to details. The user of machine cut herringbone gears should therefore assure himself of obtaining gears having a minimum error in tooth spacing, a minimum backlash, a tooth profile as true to the theoretical curve as it can practically be made, a tooth bearing clear across the face of the gear without excessive grinding together, a tooth bearing which is not only localized at the pitch line, but extends well out along the tooth profile. And, having such gears, he should see that they receive proper attention, that the lubricant is of sufficient body to carry the load without being sticky or gummy, that the shafts are kept in proper alignment and the bearings well adjusted. Good gears may be ruined in a short time by lack of attention to these details.

Hot Galvanizing

Methods Employed—Design and Construction of the Plant with Suggested Layout—Selection and Care of Equipment

BY CLAUDE O. KELL

EXPOSURE of iron and steel to the atmosphere without protection invariably causes corrosion. By coating these metals, protection can be given in two general ways, non-metallic and metallic. The non-metallic method consists in covering the material with some organic matter, such as paint, varnish or oil. In the metallic method of plating, the iron or steel is covered with some other metal, usually zinc or tin.

Galvanizing is the trade name of coating metals, most commonly steel and iron, with zinc. Three methods of accomplishing this are, (1) electroplating; (2) sherardizing or dry galvanizing; and (3) hot galvanizing. The last of these methods is the one here treated in detail.

The method of hot galvanizing can best be divided into the following operations: cleaning, fluxing, and dipping or galvanizing.

Before either iron or steel can receive an adherent coat of zinc, the article must be absolutely clean and free from all sand, rust, paint, or other foreign matter. This cleaning process may be accomplished either by tumbling, sand blasting, burning, or pickling, that is, by treatment with acids.

CLEANING BY TUMBLING

Malleable castings and small forgings can be freed from sand and scale by the wet or the dry tumbling process. In wet rolling, a tumbling barrel is packed with the material to be cleaned, sand, water, and a small amount of either muriatic or sulphuric acid. In the dry rolling process, the barrel is packed alternately with the articles to be cleaned and small cast shapes known as "shot." Great precaution must be taken in packing the barrel that too much space is not left empty, thus allowing excessive play within the barrel. This may result in fracture to fragile castings. Tumbling has the great advantage of producing a smooth, polished surface on articles and at the same time removing sand from sand pits or castings, or scale from forgings. This polished surface cannot be obtained by pickling in acids. Although the tumbling barrel is a very highly desirable part of the equipment of a galvanizing plant, it is not altogether necessary because cleaning can be done satisfactorily by pickling in acid and by sand blasting.

Sand blasting is a very efficient but comparatively slow method of cleaning sand from castings or slight scale and rust from forgings and plate work. A very cheaply constructed, but efficient sand blast, consists of a piece of ¼-in. steel pipe about 12 in. long with a T-connection at one end. One lead is taken to a source of air of about 75 to 100 lb. pressure, while the other is connected to a container of fine sand. Sand blasting produces a polished and smooth clean surface, but has the disadvantage of being expensive, due to labor cost.

Paint is easily removed by burning it off either with a torch or in a furnace. In either case care must be taken not to subject the material to temperatures that will change its chemical and physical properties.

Pickling, which is the treatment of material with acid, is the most common method of cleaning material in small plants. Sand is readily removed by a warm, weak solution of hydrofluoric acid, about one part acid and twenty parts water by volume. There is a danger involved in the use of hydrofluoric acid, however, in the formation of the silicate of the acid. This is a very poisonous gas, but it can be guarded against by suitable equipment and ample ventilation of the plant.

CLEANING BY PICKLING

Material is most commonly pickled in sulphuric acid. A solution of one part acid and twenty parts water by weight is strong enough. The solution will be more effective if heated to a temperature of about 150 deg. F. and kept agitated. This can be done easily by a blast of air from the bottom of the tank along its length. A lead pipe, 1 in. in diameter, with holes ⅛ in. in diameter drilled on 1-in. centers is suitable for such a blast in a tank of about 500 gal. capacity. Muriatic acid may be used for pickling but it is not preferred since it is not as cheap as sulphuric acid. If the pickling solution is not heated and is not agitated, a stronger solution will be necessary to accomplish results. In the interest of economy and to prevent pitting of the metal by a stronger solution, the weaker is recommended.

To prevent over-pickling of the less corroded parts, it may be necessary to remove the heavier rust and scale with a scraper. The length of time necessary for for pickling is, of course, dependent upon the condition of the material and is best governed by experience. Overpickling must be guarded against. Seams and pits in the material are indications of this. Upon removal from the sulphuric acid bath, the material should not be exposed to the air, but should be washed in fresh water preparatory to entering the muriatic bath for fluxing.

FLUXING AND GALVANIZING

Fluxing is the treatment of material in a weak solution of muriatic acid after it has been cleaned. The chloride salt which remains on the iron after it has dried, upon removal from the muriatic acid bath, acts as a very efficient flux. The consistency of one part commercial muriatic acid and fifteen parts water by weight is recommended for fluxing. To heat this mixture produces a very nauseating gas, and the advantage gained by heating is not considered great enough to warrant this disadvantage. If work is thoroughly cleaned, treatment for four hours in the muriatic acid bath is considered ample. After the material is dry it should not remain in the atmosphere long before dipping as this will allow a slight coating of rust to form.

Before material can be dipped into the zinc bath, it must be thoroughly dried, after being removed from the muriatic bath. Drying can best be done on a hot plate, heated either by gas or by a coke fire. It is not necessary to keep this plate at a high temperature,

about 200 deg. F. being sufficient. In small plants where a drying plate or oven is not available, the plates over the fire boxes around the kettle serve very well.

The temperature of zinc is a great factor in the success and effectiveness of the coating obtained. The melting point of pure spelter is 419 deg. C., or 786 deg. F. (Smithsonian Physical Tables, 1916). For galvanizing small work handled in baskets, such as small stampings and castings, the temperature should be higher, say, about 90 deg. F.; while for plate work the zinc should be about 950 deg. F. The temperature of the zinc should be recorded constantly and this can be done best by a pyrometer fitted with base metal thermocouples.

Large castings can be cooled by dipping in warm water covered with oil. Small castings should not be dipped into water to cool, but allowed to cool in the air as dipping these in water may cause cracking. Plate work should be sprinkled with water and allowed to cool in air. This produces the spangled appearance of such pieces.

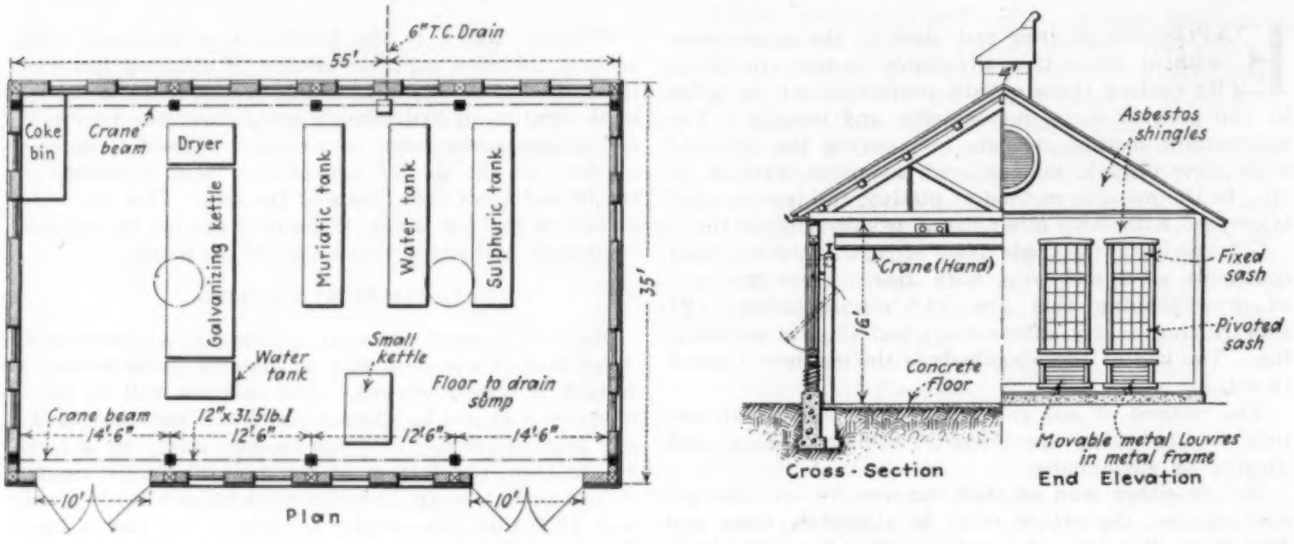


FIG. 1—PLAN AND ELEVATION OF GALVANIZING PLANT

Before an article is dipped, the surface of the zinc should be cleaned with a scraper and covered with gray salammoniac, which acts as a flux. Gray salammoniac is preferred to white salammoniac, since it is cheaper and does not vaporize as readily. A few drops of glycerine will make the salammoniac adhere as a mass on the surface of the zinc. In dipping, pass the article through the salammoniac slowly, until it is entirely submerged. This operation must be done slowly, to prevent sputtering of the zinc which might injure the workmen. Allow the article to remain in the zinc entirely submerged until it has reached the temperature of the zinc, which is indicated by the ceasing of the bubbling action. Withdraw the article slowly through the salammoniac and examine it to see that every part of the surface is coated. If not, apply salammoniac freely to those parts not covered and lower again into the zinc. Examine again before preparing to withdraw the article finally. Before hoisting the article from the zinc for the last time, brush the salammoniac clear, leaving a clean surface on the zinc. Allow all surplus metal to drip into the kettle.

The quality of work in galvanizing is governed to a large extent by the purity of the zinc. The kettle must always be kept free from dross, which is a compound formed by iron and its impurities passing into solution with the zinc. Sources of dross are mill scale on material galvanized and the iron from the kettle itself. For this reason it is most important that the kettle be constructed with suitable material.

Plant Construction and Equipment

It is most important that the building in which a galvanizing plant is housed, be designed to give a maximum amount of ventilation, in order to insure the expulsion of all fumes arising from pickling tanks and the kettle.

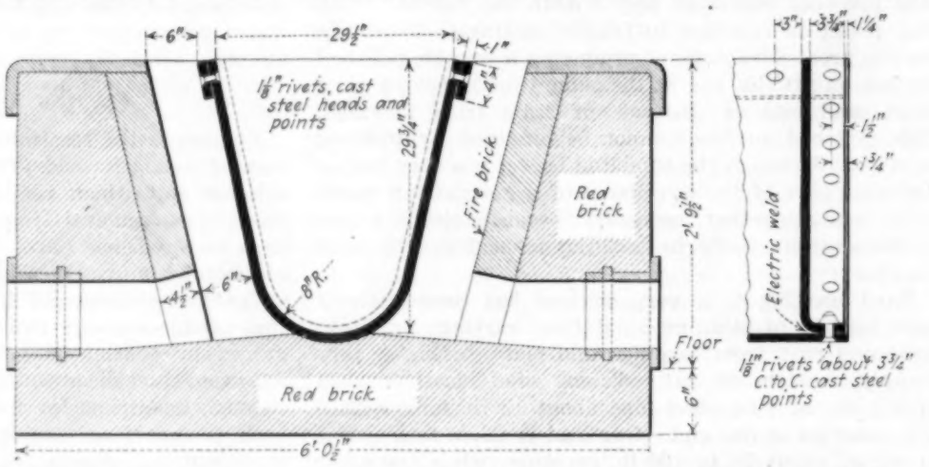


FIG. 2—SECTIONAL VIEW OF U-SHAPED KETTLE AND METHOD OF INSTALLATION

In Fig. 1 is shown the plan and elevation in section of a building designed to house a plant of about 3 tons per day capacity. The long windows are spaced closely together and are pivoted, enabling them to be opened

wide. Below the windows are louvres which act to create a draft upward through the ventilators when weather conditions make it necessary to keep the large windows closed. Natural ventilation is preferable because a forced draft blower is liable to act to keep the fumes low within the plant. Hoods may be designed to cover the pickling tanks and kettle but these have the disadvantage of interfering with work. A concrete floor is desirable because it is not materially affected by acids and can be cleaned readily. The plan view gives the logical layout of tanks and kettle designed to minimize transportation within the plant and

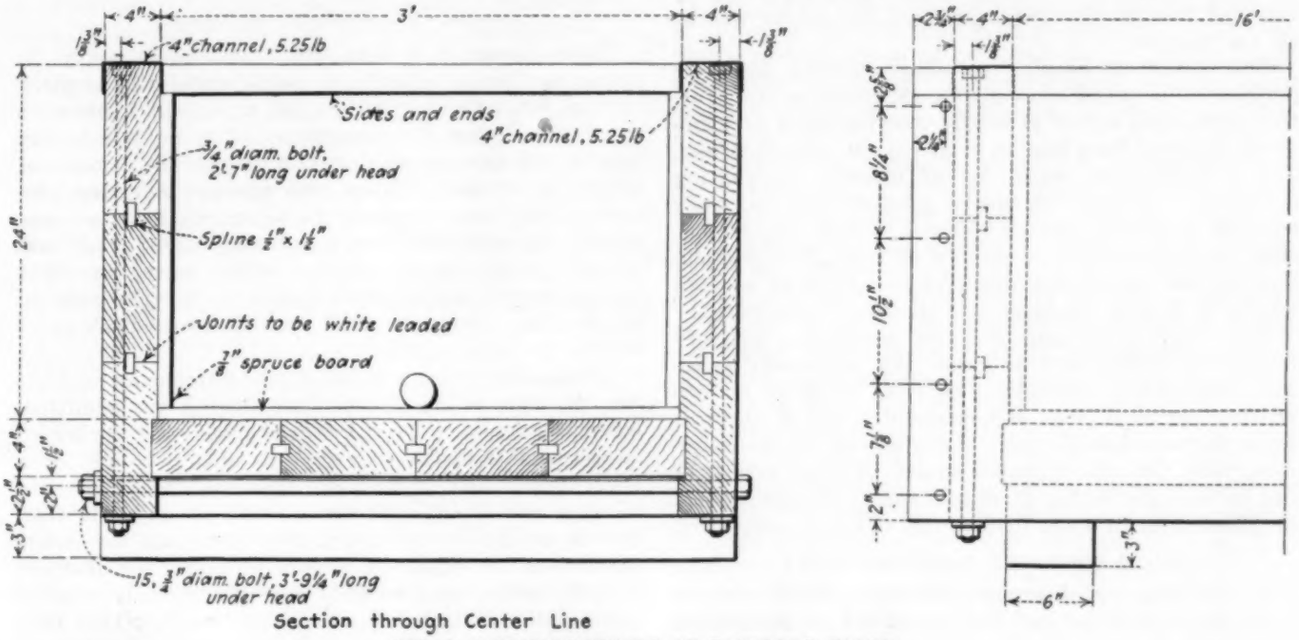


FIG. 3—DESIGN DETAILS OF PICKLING TANKS

facilitate handling of materials. For transportation an overhead traveling air hoist is most satisfactory where compressed air is available for power. This type has two advantages, viz., its atmospheric exhaust works no hardship upon operators; and its ruggedness minimizes repair and upkeep costs.

To determine the most satisfactory grade of iron with which to manufacture galvanizing kettles, extensive experiments have been made. These have shown, conclusively, that the resistant qualities of iron to the molten zinc are nearly in proportion to the degree of purity of the iron. Carbon and nickel, as impurities, particularly, should be avoided. Specifications for a satisfactory iron should allow no greater percentages of impurities than the following:

Carbon	0.12 of 1 per cent or less
Manganese	0.2 of 1 per cent or less
Phosphorus	0.01 of 1 per cent or less
Nickel	None.

The U-shaped kettle as illustrated in Fig. 2 in section is the most satisfactory design. This design has advantages over the rectangular shaped kettle in that it permits a more even heat distribution through the volume of zinc and is more easily drossed and kept clean. In the rectangular kettle dross collects and remains in corners and along the edges. This causes overheating in these parts and thereby accelerates the destruction of the kettle by burning. Plate at least 1 in. thick should be used, and if possible the kettle should be rolled from a single plate. Riveted joints except at the ends should be avoided. To facilitate drossing the kettle and to prevent the dross adhering to the bottom of the kettle, it is good practice to keep about 8 to 10 in. of lead in the bottom of the kettle.

The life of a kettle depends to a great extent upon the care in firing. Precaution should be taken not to allow the zinc to solidify and to prevent excessive temperatures with the danger of burning the kettle. This can be done with little attention by using oil or gas fuel. If coke is used, uniformly clean fires about 6 in. thick and in depth equal to the height of the zinc in the kettle, should be kept. Large coke is best since this gives a greater percentage of voids which allows better circulation of air throughout the fire.

In firing a new kettle, it is of greatest importance that the operation be slow and that no part of the kettle be subjected to concentrated heat. Before lighting the fires, the kettle should be packed carefully with enough ordinary pig lead which, when melted, will have a depth of at least 8 in. On top of this, slab spelter should be packed making sure that all of the surface of the kettle is in contact with the zinc. When possible, it is well to pour melted zinc down the sides of the kettle to insure its surface being covered. No less than forty-eight hours should be required to melt down a kettle of zinc and bring it up to temperature ready for use. It is believed to be economical to use only first-class virgin spelter marketed by a reliable firm rather than use the remelt spelter which may be obtained at a much lower price. In the latter case it has been found that a great percentage of the spelter is lost as dross.

Details of design of suitable pickling tanks are shown in Fig. 3. Either long leaf pine or spruce are preferred as material with which to build them, in view of economy and the resistant qualities of the woods to acids. The edges of the tanks should be protected by inverted channel bars as shown. To protect the bottom and sides of the tank against cutting and pricking by plate edges, a thin lining of spruce should be used. This can be easily and cheaply renewed and prolongs the life of a tank greatly.

P. A.—Discussion

By C. J. Morrison

The remarks of Charles W. Lee on page 337 regarding purchasing agents are very much to the point and treat an important subject—one so important in fact that more should be said until a large number of purchasing agents are reformed.

In too many cases the thought seems to be that any dub can do the purchasing, and totally incompetent and inexperienced men are made purchasing agents. Before being made purchasing agent, a man should have at least some experience in both manufacturing and selling, and the broader the experience, the better will he fill the position.

This thing of keeping salesmen waiting for long periods, of haggling over prices, of knocking the firms they represent, and of generally treating them as something different from human beings is not only all wrong, but is costing an awful lot of money. Purchasing agents and salesmen should be good friends and work together for their mutual interest. That this is possible is illustrated by a number of cases, but particularly by the purchasing agent of a very large concern which, in fact, is the largest of its kind in the world.

This man has a large corps of assistants, but they handle the details and he personally sees every salesman who calls. Moreover, he tries to keep no one waiting for more than a few minutes and if there is to be an unavoidable delay, he goes out to the salesman, tells him the probable length of time before he can be seen, and either gives him a definite appointment or allows him to wait, just as the salesman may elect.

Rules for the Purchasing Agent

A very successful general manager wrote instructions for a man he had just promoted to purchasing agent, and the ones which apply to business in general are given below:

See every salesman who calls.

Treat a salesman as courteously as you would a customer.

Do not keep a salesman waiting. If a delay is unavoidable, go out to him and offer a definite appointment.

Tell no salesman from whom you are purchasing.

Tell no salesman the prices you are paying.

Be truthful to the salesmen.

Do no haggling over prices and do not tell a salesman at what price you will buy. It is the salesman's duty to name his price. We do not buy from a house that names a price and then lowers it to make a sale. Our competitors might buy from the same house at a still lower price.

Do no knocking. If you are not satisfied with the service or merchandise of any concern, tell the salesman of that concern, in a courteous manner, the trouble. Talk to no salesman about any company except his own and yours and be sure to advertise your company.

Study the markets, the political situation, the financial conditions, and the agricultural prospects—all of these for both this country and abroad. Your department is supplied with the best trade and technical journals, with a daily financial and a daily market report paper, and with one of the leading newspapers and you are supposed to study them.

On a falling market, buy only enough at a time to keep the plant running and allow the stock on hand to fall to a minimum, but on a rising market buy in large quantities and increase the stock to the maximum. Never be in a hurry to buy. Few buy actually at the bottom and it is far safer to buy a few points above the bottom, when prices have turned definitely upward, than to buy at what you think is the bottom only to find that prices are still falling.

Study the scrap and spoilage reports from the plant, and if they are rising above normal, find out whether or not the fault lies with something you are purchasing.

Make frequent trips through the plant so as to familiarize yourself with the uses made of the things you purchase. Perhaps you can suggest some change to reduce costs, but no change should be made until after the factory manager has been consulted and the consent of the general manager secured.

Be sure that prices, discounts, terms, quantities, delivery dates, f.o.b. point, etc., are clearly stated.

Specifications are provided for nearly all of the regular items that you purchase and with each purchase order should be included the specifications for the items on that order. When specifications are not provided, be sure that the goods ordered are so specifically described that no misunderstanding can arise.

A Case of Expensive Ignorance

These paragraphs from the instructions apply to almost any business and this would make a good place to stop, but I feel inclined to tell a personal experience which illustrates the ignorance of some purchasing agents and also shows that the management does not always do its part. Some time ago our salesmen who were calling on a company to whom we were anxious to sell reported that the purchasing agent could not be seen as he seemed to have duties more important than interviewing salesmen and that the assistant to whom they were referred was "impossible," so I decided to make a call.

Although my card was sent to the purchasing agent it was the office of the assistant to which I was admitted. After delivering a long talk on prices and trying to impress me with the idea that he always bought at a lower price than anyone else, the assistant consented to allow me to tell him what I had to sell. He then told me what I already knew, that they made the article themselves. I explained to him that the manufacture of this article was entirely foreign to their regular work, and this fact, combined with the fact that they made the article only in small quantities, would make the cost higher than our selling price, as the article was a specialty with us and was made in very large quantities on special patented machines of our own design which were far more efficient than any machine they could purchase. Moreover, the fabrication of this article gave a very large waste of raw material for which they had no use, while we used it for other purposes. As this sounded reasonable, he consented to receive a quotation and I asked for specifications, to which he replied, "We have no specifications, but I will give you samples."

He sent for samples, and after receiving them I said, "Now if you will tell me the limits, you will receive a rock bottom quotation in the morning's mail."

He replied, "We have no limits. Your goods must be exactly like the sample, without any variation whatever." When I tried to explain, he said, "Limits would have nothing to do with the costs. If you cannot make the article, say so, while if you can, submit a price; but remember that your articles must be exact duplicates of the sample or they will not be accepted."

As argument availed nothing, I left and the next day submitted a very low price for the article "to be made similar to sample within the usual commercial limits for this article which are —," giving the limits we used for other customers. We did not get the order and, as far as I know, that company is still making the article at a much higher price than it could be purchased because no one will make it for them "exactly like sample." I wonder how many others are in the same boat.

Methods of Machine Tool Design

Fourth Installment of Section on Feed Mechanisms—Rack Feeds and Their Limitations Cam Feeds—Intermittent and Uniform Motion Cams

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

FEW REMARKS need to be made about the main elements of a rack feed mechanism. As a rule, a rack feed is not used where accurate distances must be obtained. A high degree of accuracy would not be obtainable with racks and pinions as ordinarily made in the machine shop. Nevertheless, there are cases where it is desirable to lay off distances by means of rack and pinion. In such cases one should make the pinion with circular and not with diametral pitch so as to be able to say that one revolution of the pinion corresponds to four, five, six inches, or whatever it may be. As a rule, a rack feed is not used for the heaviest kind of work so that the very heavy pitches need not be used. If the work is moderately heavy, the rack should be fastened to the frame of the machine by screws and heavy dowels, or preferably by screws and cross keys.

Large Reduction Advisable

One should keep in mind, when designing a rack feed, that the rod or shaft which comes from the driving end and goes to the rack feed mechanism should run at relatively high speed; that is, it should make a great many revolutions for one revolution of the pinion. There are two reasons why this is necessary. In the first place, the feed shaft is, as a rule, of considerable length and must be kept limited in diameter to meet the conditions of the feed mechanism—let us say in the apron of a lathe. Therefore it is impossible to avoid excessive twist and perhaps breakage of the rod unless it runs at much higher speed than the feed pinion. In the second place, such a rod transmits the power by means of a spline, and the coefficient of friction between rod and key is necessarily great, partly because neither the spline nor the key has the best kind of finish nor could this be maintained if they had it, and partly because the conditions of lubrication are necessarily of the poorest for a splined rod.

How a Direct Drive Would Act

Suppose the splined rod should be keyed directly to the rack pinion. Let us suppose this rack pinion to be of 3 in. pitch diameter and the splined rod to be 1 in. in diameter. Then for one revolution of the splined shaft the key must travel in an axial direction as much as is the circumference of a section of the rod. The result is the same as if the load were pushed in a horizontal direction and had to climb an incline of 45 deg. Besides, there is to be considered the large friction angle which may cause the same result as if this load had to climb at an angle of 45 plus the friction angle. This angle may be so considerable that the device becomes self-locking. If, on the other hand, the splined shaft were so geared to the rack pinion that twenty revolutions of the shaft were required for one revolution of the pinion, then the key would have traveled only $\frac{1}{20}$ of the previous distance per revolution of the shaft. Thus the load would have been pushed up a gentle incline. Another reason why this large reduction is necessary is that otherwise the pressure of the spline against the key would be several times the load on the rack pinion and would cause excessive wear. If the lathe carriage had been working for some time over a certain region of the lathe bed, the spline would have been worn to a shoulder, causing trouble when later on we want the carriage to work in some different region.

It is always possible to give the feed rod the necessary speed but it is more difficult to arrange this matter properly when a feed screw is used also as feed rod. Let us assume that we have a medium sized lathe upon which threads can be cut from one to twenty-four to the inch and in which the smallest rack feed is 0.01 in. or, practically, one-fourth of the finest lead. If the gearing at the head-stock end is so arranged that we will get $\frac{1}{24}$ pitch, this same gearing will also make a 0.01 in. feed. If the gearing is set for the largest possible lead, namely 1 in., we shall obtain with the same arrangement a $\frac{1}{4}$ in. feed. If this screw had a lead of 1 in. which, as we found, was desirable for screw feed, we would have the condition that one revolution of the screw would cause $\frac{1}{4}$ in. feed when it is used as a feed rod. This small reduction, though it would not lead to self-lock, is undesirable, causing excessive wear and producing a hard and irregular action of the feed.

Cam Driven Feed Mechanisms

Books might be written about cam feeds and many excellent articles and treatises have been written on the action of cams. We shall have to confine ourselves here to those properties of cams and those requirements of cam feeds which are directly applicable to the design of machine tools. Cams are almost exclusively used in automatic machines because they are necessarily limited in their range and, at a first glance, do not seem to lend themselves to variations in the requirements of the machine. As a matter of fact, such variations are not possible if we consider the cam alone. A cam, however, considered in combination with its driving mechanism, may lend itself to many variations in the duty it has to perform.

The simplest kind of cam and cam arrangement has a constant lead, advances the machine element the same amount at all times, and has provision for returning that element as quickly as possible. Change gears or any other speed variator in the driving mechanism of that cam may permit of changing the amount of time required for a complete cycle. The requirements for such a cam are that its slope should be as gentle as possible and that in order to obtain the greatest economy of time the return should be as steep as practical.

There are two distinct ways of utilizing cams in a mechanism. The cam may either be used for one definite function or it may be arranged to take care of one complete cycle of the machine. To illustrate: The cam used for the shifting of the belt on a Brown

For the author's forthcoming book. All rights reserved.

and Sharpe screw machine belongs to the first class. It has one function only, it shifts the belt and does nothing else, and moves only at the moment when the belt must be shifted. A cam of the second kind is the one used on the Spencer Hartford screw machine, on which there are all the elements required for the various advances and retreats of all the turret tools as well as for the indexing. Idle spaces on this cam permit another cam on the same shaft to attend to the chucking, stock feed, etc., between the feeds of the turret and cross slide tools. If the arrangement of the machine would permit, it might be possible to have these two cams consolidated into one. The full revolution of these two cams completes an entire cycle of the machine.

Functioning of a Typical Cam

There are other cams on such machines, but they are all mounted on the same shaft. The effect is the same as if they were all built into one member. Though we say that one cam takes care of the advances of the various turret tools, the truth is, each turret tool has its own cam but all cams are mounted on a single drum. This mounting of a number of cams on a single drum serves the purpose of assuring a proper sequence of operations and a proper proportioning of the rapidity of feed and the amount of advance of each tool. There is no possibility of the machine getting out of time. Operations cannot be mixed up if once properly set. To analyze better the functioning of such a cam we will take a concrete example, selecting some imaginary screw machine with four turret tools, one cross slide tool, and so arranged that the indexing of the turret is accomplished by a cam and not by the mere backward movement of the turret. Starting with the first tool, we will have the following sequence of operations:

a — quick traverse forward of first tool, also quick traverse forward of cross slide tool,
b — feed of first tool and cross slide tool,
c — quick return of first turret tool and cross slide tool,
d — dwell of first tool and cross slide tool, and
d-1 — unlocking of the turret,
d-2 — indexing of the turret,
d-3 — locking of the turret,
e — rapid advance of second tool,
f — feed of second tool,
g — quick return of second tool,
h — dwell and, at the same time,
h-1 — unlocking of the turret,
h-2 — indexing of the turret,
h-3 — locking of the turret,
i — rapid advance of third turret tool,
j — feed of third turret tool,
k — quick return of third turret tool,
l — dwell of third turret tool and, at the same time,
l-1 — unlocking turret,
l-2 — indexing turret,
l-3 — locking turret,
m — rapid advance of fourth turret tool,
n — feed of fourth turret tool,
o — quick return of fourth turret tool and, while these operations have gone on, there may have been,
p — shifting of the belt for the purpose of tapping, and
q — shifting back of the tapping belt,
r — dwell of fourth turret tool and, at the same time,
r-1 — unlocking turret,
r-2 — indexing turret,
r-3 — locking turret,
s — dwell for first turret tool and, at the same time,
t-1 — opening chuck,
t-2 — feeding chuck,
t-3 — closing chuck,
t-4 — returning feed shell.

This completes the entire cycle. To a certain extent some of these elements may overlap each other.

Such a cam may be run either at a uniform speed or it may have a slow and fast motion. We will assume that in the imaginary machine we have under consideration the cam will sometimes move slow and sometimes fast, the slow motions being used only for feeding. Then we find that all the movements except for *b*, *f*, *j*, and *n* are fast movements of the turret. Thus, only a relatively small fraction of the circumference of the drum is used for the purpose of feeding whereas all the rest is used for what might be called "non-productive movements." As a result, such a cam must be made of large diameter, though the amount of feed and the number of tools to be fed may be small.

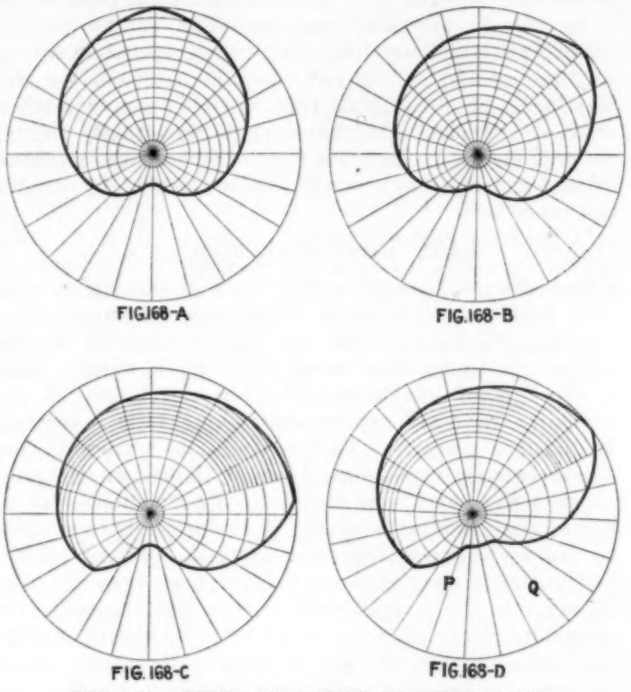


FIG. 168. SEVERAL FORMS OF FEED CAMS.

There is another difficulty in connection with the camming of such a machine. To set up a new job requires a complete analysis of all the detail operations and a careful calculation of the parts of the cam drum available for each function. We will go further into this matter later on and first consider the various other arrangements in existence or possible arrangements which might be made.

Perhaps the simplest arrangement of all is the cam which turns at uniform speed, has a uniform advance, a uniform return which may be at the same or different speed as the advance, and no idle space to permit some other function to take place. Such cams might be used for a variety of machines, as for example filing machines. A modification of this arrangement would permit a machine to stop at the end of every cycle by the throwing out of a clutch or a drop-worm. Cams of this description are quite commonly used in special

machines. They become more generally useful if the advance is not uniform.

Fig. 168-A shows a cam with the uniform and equal advance and return. Fig 168-B shows the cam modified with a uniform advance and rapid return and Fig. 168-C shows the same type of cam for rapid advance, slow feed, and rapid return. Fig. 168-D, finally, shows a cam which has the same characteristics as Fig. 168-C, except that it has idle spaces left for other operations. This idle space is a concentric part, *PQ*.

The cams are shown in the illustration as disk cams, though there is no reason why they should not be constructed as drum cams. As the diagram shows them, no provision is made for the return and this would have to be accomplished by a weight or spring whereas it might be accomplished by having a groove act on the roller instead of depending on the outside of the cam disk. The shape of the return branch of the cam, 168-C, is not objectionable when a spring or weight brings the slide back but if such a cam were provided with a groove, so that the cam becomes active instead of passive, there might be danger that the device would become self-locking, and it might be necessary to make the return less rapid. As a compromise, the cam might be made with a groove and, in addition, a weight or spring might be provided to bring the slide back so that the return side of the cam only works if, for some reason or other, the spring or weight should not be sufficient.

Keeping Operations in Synchronism

When a cam is constructed on the principles of Fig. 168-D—that is, with idle space for some other operations—it becomes necessary to connect the two functions in such a manner that they cannot get out of time with one another. The simplest way of accomplishing this is to have the other functions also controlled by a cam and then place the two cams on the same shaft and in the proper relation to each other. If, for instance, a slide at the righthand end of the machine had to be advanced and returned, after which a similar slide at the lefthand end of the machine had to go through the same movements, it would be natural to use two cams on the same shaft, each one occupying about one-half of the circumference. If the two slides to be moved were close together, the two cams would be consolidated into one, each function requiring about one-half of the circumference. We see, then, that whether we use one or two cams their size is not changed and must be as large as if only one cam were used for both operations. When there are a great many different operations to

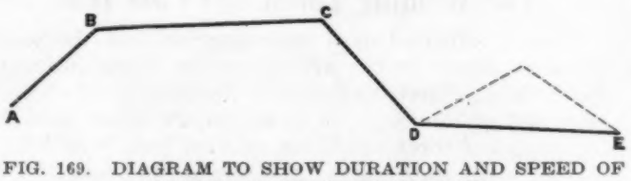


FIG. 169. DIAGRAM TO SHOW DURATION AND SPEED OF VARIOUS MACHINE FUNCTIONS.

be performed on the machine, the cams naturally take on very large proportions.

It might be thought that the size of such cams could be reduced by performing part of the operations at a high speed but as a matter of fact this has a tendency to increase, rather than to decrease, the final size of the cam. To illustrate how this may happen we will take a concrete example. In Fig. 169, the full line from *A* to *B* shows the rapid advance of the slide, from *B* to *C* feed, from *C* to *D* return, and from *D* to *E* dwell, during which another operation takes place. The cam intended for that other operation is indicated by dotted lines. This second operation is not a feed for a tool and the steepest permissible slope for the cam might be used here. This steepest slope we will assume to be 45 deg. and this angle is actually used on the advance and return of the main cam (shown in full lines).

It will be noticed that the dotted line is not shown at this angle of 45 deg. The reason is that in our device the member to be moved by the dotted line cam is very heavy and does not permit of the same rapidity of movement as that member which was shown by the full line cam. If the two cams had been separate and without any connection with one another, the dotted line might have been drawn at an angle of 45 deg. and we would have given this cam a speed which was proper for the heavy member to be advanced. In that case the dotted line cam would have occupied less space than it does now. Under such conditions, then, we have the choice either of making the dotted line cam at an angle of 45 deg., reducing the fast speed of the entire mechanism and thus lose time, or of making the dotted line cam of gentler slope and thereby increasing the size of the entire cam.

Electrolytic Deposition of Iron for Building Up Worn or Undersized Parts

By David R. Kellogg

The electrodeposition of iron has been practiced for many years. During the war, the British army repair shops developed a method for building up worn parts of automotive machinery, aero engines, etc., using the cold sulfate bath and low-current density method. The method has been used successfully in commercial work for the production of about 6,000 repaired parts, therefore experiments along the same lines have since been made at the Westinghouse research laboratory.

Current used for cleaning was obtained from a ¾-kw. 60-volt, house-lighting generator, direct connected to a 2-hp., 870-r.p.m., 440-volt, three-phase, type CS induction motor; while the plating current was taken from the storage batteries at any desired voltage. The anodes were made from 0.036-in. Armco iron made into cylinders 5 in. long by 8 in. in diameter with a disk of ⅛-in. micarta, having a 2-in. hole in the center field at each end of the cylinder for stirring. The anodes were hung on a wooden rocker frame driven by a wooden connecting rod directly connected to a small reducing gear, such as is sold by most of the apparatus supply firms; three-gallon stoneware crocks were used as containers.

Uncertain Behavior

A solution used by Thomas, 75 g. of the crystallized ferrous ammonium sulfate per liter, was tried, using the current density recommended by him; namely, 0.33 amp. per sq.dm. Under these conditions the deposit on a ½-in. (12.7 mm.) rod of cold-rolled steel was smooth, bright, and adherent; it withstood bending and refused to chip off even when attacked at the junction of coating and parent metal with a cold chisel. A current efficiency of

Extract from a paper presented at the February meeting of the American Institute of Mining and Metallurgical Engineers, in New York.

about 75 per cent was obtained, the rate of deposit being about 0.000197 in. per hour.

Baths thus prepared were rather uncertain in their behavior, being especially likely to oxidize when used with small pieces. Adding ferrous-carbonate "mud," kept under water after preparation, somewhat reduced this tendency to oxidize and hence increase in acidity. Powdered charcoal helped to secure a good deposit, and was used in all subsequent work.

After the work had been cleaned with gasoline or benzine, it was made the cathode in an alkaline bath containing about 5 per cent commercial lye and about the same amount of sodium carbonate, the exact amount being immaterial. A current density of 3 to 5 amp. per square inch was used. The work was treated in this bath for 3 min. Then it was washed in running city water and made the anode with approximately the same current density in 20 to 30 per cent commercial sulfuric acid for an equal length of time. As a matter of fact, the current in the acid cleaning bath was always adjusted more with respect to the free gassing of the anode than with respect to the actual current density.

When for any reason the cleaning current was too low to make the work passive, cleaning was unsuccessful, the piece came from the bath dark colored, and a good coating could not be produced. If the work were moved about during the anode cleaning it rapidly became active but again became passive on cessation of the motion. When this condition was very noticeable, it was a good indication that the cleaning current was close to the lower limit. With a current density of 5 amp. per square inch this effect was not so noticeable. After cleaning in this manner, the work was well washed and immediately transferred to the plating bath. With the plating solutions at room temperature, it was possible to deposit at the rate of 1 amp. per sq.dm., which is three times the rate given by Thomas.

Durability of the Deposit

This process gave smooth, tough, adherent coats which, when deposited on a carefully ground rod 0.485 in. in diameter and then ground to a thickness of 0.001 in. could be pressed through a hole in 1-in. cold-rolled steel 0.0005 in. smaller than the finished size of the rod, and then pressed back again with no signs of stripping. These test rods could be bent and mishandled in various ways with no damage to the coat.

A motor shaft having bearings ¾ in. in diameter by 1½ in. long was purposely finished 0.002 in. small in diameter, plated oversize, reground to proper dimensions, and then assembled and run in bronze bearings for 1,000 hr. with a load of 50 lb. per square inch projected area, using a short stiff belt with a clipper joint in order to give a pounding effect as well as friction. At the end of the run it was found that the wear was 0.0002 in., which is just a trifle less than the original material shows in factory life tests.

Plug and thread gages have been repaired by this means and have given good satisfaction although they are not as hard as heat-treated tool steel. It is, of course, possible to carburize such pieces, when they will compare favorably with the original gages.

Resistance to Cutting

Another interesting job done by this method was on the throw bearing of a crankshaft of an experimental gasoline engine where the maximum pressure was about 650 lb. per square inch. This was given about 100 hr. intermittent running and then 400 hr. continuous running. During the first period, two "freeze ups" occurred, as a result of experiments with various bearing metals; yet when the engine was taken down for inspection the bearing surfaces were in perfect condition and showed a wear of 0.00025 in. Many press fits and running fits have been repaired for shop use and no case of failure has occurred. Coatings obtained by this method are much harder than pure iron; they are usually about 220 Brinell.

Some work of N. B. Pilling, of the Westinghouse laboratory, as yet unpublished, has shown that the brittleness due to occluded hydrogen may be completely removed by heating for ½ hr. at 300 to 400 deg. C.

When cast iron is put through the electrolytic cleaning process, it emerges from the acid with a coating of graphite. A piece was dipped in arsenic-chloride solution and then copper plated in an acid copper-sulfate bath. Iron coatings deposited on this base were fairly adherent.

Acidity of Bath

In connection with all this work a rather close watch of the acidity has been maintained. It now appears, that this is unnecessary as the hot concentrated bath produces such complete anode corrosion that oxidation is practically negligible. The addition of small amounts of ferrous-carbonate mud is still practiced, but the amount used is very small. These baths may be left for weeks when not in use, without any serious oxidation. They have also been worked for weeks at a time, most of the work being done during the daytime, as the rapid rate of deposit, 0.004 to 0.005 in. per hour, makes it possible to do almost any job in one working day.

In addition to a large number of test pieces, between seventy to eighty salvage jobs have been done for the shop, running all the way from the badly scored end of a 1/20-hp. motor to an experimental airplane propeller hub. For the electrolytic cleaning of the larger pieces, we used a 300-amp. arc welding M-G set, with the series field coils short-circuited and with a potentiometer rheostat across 110-volt direct current for the shunt field. This arrangement, together with the regular field rheostat, gives a fine adjustment of current, so that the set may be used for small work, or for work requiring up to 450 amp. for cleaning.

Great credit is due to Leon McCullouch, J. P. Thomas, and J. D. Alleg who carefully handled the experimental part of this work and contributed many valuable ideas to its development.

The Welding Torch and Cast Iron

We are informed by a correspondent that the statement contained in the article on the "Application of the Welding Torch to Railroad Repairs," published on page 444 of our Sept. 21 issue, to the effect that the oxy-acetylene torch would not cut cast iron, is no longer correct. He states that the Oxweld-Acetylene Co. of Chicago has perfected a torch that will do this work.

In making the statement that the torch would not cut cast iron the writer of the article had no intention of conveying the impression that the oxy-acetylene flame would have no effect upon this metal. The reason that the torch has hitherto been considered impractical for this purpose is that the cast iron yields too readily, leaving a ragged, uneven edge instead of the clean knife-like cut produced upon steel.

Taking the Air in England

Present State of the British Airplane Industry—Post-War Stagnation in Bristol Plant 400 Hp. Radial Engine and Ten-Passenger Plane

BY HENRY OBERMEYER AND ARTHUR L. GREENE

A GREAT deal has been written about the impoverished condition of the American aircraft industry, the failure of Congress to lend a helping hand, and the indifference of army and navy officials to the future development of the Air Service. One hears the same sort of thing in England. Parliament is appropriating little or nothing and the British aircraft factories are living on the crumbs that fall from the London to Paris commercial and passenger lines and from certain distant principalities which are engaged in wars at present or expect to be so occupied in time.

Admiral Sir Percy Scott, a leading exponent of a more extensive British Air Force, in a recent article contributed to the London *Times*, notes that the British Government is preparing to spend only £11,000,000 on its air defences. This sum he terms "ridiculous."

"The size of our Naval Air Service to-day is simply absurd," he adds. "During the war it was found necessary to equip every light cruiser with a fighting aeroplane. Today we have six fighting aeroplanes for the whole Navy, less than one per fleet."

The general situation described by Admiral Scott is fully confirmed by a visit to Great Britain's greatest airplane factory by the writers. The machines of this concern, the Bristol Aeroplane Company, Ltd., are recognized as the official standard in use by the British Government. The 400 hp. Bristol "Jupiter," a nine cylinder air-cooled radial engine, virtually every part of which is manufactured and assembled in the company's shops, is said to be the only airplane engine that has ever passed both the French and British official tests. It weighs only 698 lb. or 1,745 lb. per hp., an unusually low proportion.

Industry in Peace

The factory today is a graphic example of the transition from war to peace in the airplane industry of the country. It is their ready adaptation to the new conditions that has enabled the British builders to advance to their present position and not any paternal assistance. The necessities of the war enabled British manufacturers to indulge in practical experimentation on a scale impossible for American firms whose planes were never put to actual use at the front. Many of the improvements developed in English factories during the war period have been lasting and have proved as important to the development of commercial flying as to that of scouting. This circumstance has brought England well to the fore and it is the general impression among manufacturers there that America is only marking time.

The wartime spurt, then, is the chief reason why British manufacturers have advanced in the face of discouragements as real as those in America. In some cases they have even advanced further than the market. In anticipation of extensive passenger-carrying operations on the Continent, the Bristol factory some time ago turned out an air limousine capable of carrying sixteen persons in addition to the pilot and mechanic. The cabin of the machine represented the *n*th degree of twentieth century luxuriousness. There was but one thing the matter with it. There were no passengers. Only on rare occasions was it possible to collect sixteen passengers at the same time who wanted to make the trip.

For the time being, therefore, Bristol is compelled to concentrate on the ten-passenger machine, shown in Fig. 3, which is amply spacious to meet the demands of the immediate future. This temporary check has left the inventive faculty free to experiment with new types of engines, which has now reached its culmination in the huge air cooled static radial, the "Jupiter."

American Development Slow

The manufacturers of the Bristol machines are so confident that they have left our own manufacturers behind that they are beginning to ask: "What is the matter with the United States?" They assert that there has been little, if any, new development in aircraft manufacture in America since the collaborative Liberty motor. It might be here mentioned that the British experience with the Liberty motor has left an impression that America is more given to quantitative than to qualitative production. They admit that the principle of the American engine was excellent, but, in a majority of cases, it had to be taken apart and reassembled before it would work up to standard.

British headway in the development of aircraft engines is far in advance of progress in the construction of planes, partly, of course, owing to lack of support from the Government and the general public. The fact is, the type of planes now in flight is considered quite satisfactory for the uses to which they are being put. Except for minor details, it is practically the same as that used by the British air forces during the last few months of the war. From the Bristol "Fighter," which is being used by Spain against the Moors, as well as by other governments, Bristol has developed a three seated touring plane for the Western Australia Mail Service. This machine is scarcely different in principle from the machines of 1917.

Engines Further Developed Than Planes

Active development of aircraft engines by Bristol is comparatively recent, dating back scarcely more than two years. Before that time, Bristol planes were equipped variously with the 110 hp. Le Rhone, the 275 hp. Rolls-Royce, the 240 hp. Siddeley Puma, and the 300 hp. Mercury. In beginning the construction of its own engines, Bristol took over the entire business of the Cosmos Engineering Company, Ltd., located on the Filton training field near the outskirts of Bristol proper, together with all patents, designs and rights in connection with the various engines previously manufactured by that organization.

Bristol devoted its attention from the start to the radial type of engine as likely to develop the greatest power with a minimum of weight, always the great de-

sideratum in aircraft design. The additional advantages of the air-cooled engine influenced the trend of subsequent experiments.

The reasons which decided the Bristol company to devote its attention to the radial engine are possibly obvious. Experimentation proved that the grouping of many cylinders around a single throw crankshaft would permit the use of the smallest possible shaft and crankcase, and, as these are two of the heaviest single parts in an aero engine, the saving thus effected in motors of radial design is considerable. Another important feature is the short stiff crankshaft in which periodic vibration is cut to a minimum.

Reasons for Use of Radial Engine

The advantages of a radial air-cooled engine over power units of other types were so apparent that the Bristol company early in its experiments devoted nearly all its time to the development of this type of engine. It represented a feature of commercial airplane engine design even more important than that of the military plane. It meant that the possibility of decreased weight implied a proportionate increase in the revenue producing cargo which could be carried.

Another factor taken into consideration was the increased reliability arising from the absence of possible leakage in the water connections, pipes, jackets or radiators; the impossibility of freezing either at high altitudes or in cold weather, and the freedom from trouble arising from the overheating of the water during flight.

The nine cylinders of the Bristol engine as now assembled are in a single plane and have a bore of 5¾ in. with a stroke of 7½ in. The engine is made in two types, the first ungeared and the second fitted with an epicyclic geared reduction of 0.656 to 1. The reduction gearing is interposed betwen the crankshaft and the propeller, and with the engine running at 1,600 revolutions per minute and developing 400 B.H.P., the propeller turns at 1,050 revolutions per minute.

Unique Mixture Distribution

The cylinder heads are of aluminum with two inlet and two exhaust valves, and take care of the distribution of the major portion of the heat. The single induction pipe branches at the entry into the cylinder head while the exhaust is conducted away through two separate heads, thus obtaining a smooth flow of mixture to the cylinders and allowing a free passage of air across the cylinder head. See Figs. 1 and 2. The crankcase is an aluminum casting of two parts, the joint being in a vertical plane.

One of the most interesting features of the "Jupiter" engine is the induction chamber, shown in Fig. 6, an aluminum spiral casting constituting a three-start spiral. The annular cover of the induction chamber carries three Claudel carburetors, each of which feeds a separate convolution. One carburetor supplies mixture to the second, eighth and fifth cylinders, the second carburetor supplies the third, ninth and sixth cylinders, while the third supplies the fourth, first and seventh. This arrangement, it is claimed, allows the mixture a clean sweep from the carburetor to the induction pipe. It further isolates the cylinders into three perfectly balanced groups so that, should one or even two carburetors fail to act properly, a sufficient number of cylinders will remain in action to carry the plane.

The entire engine is supported on a removable framework of thin wire struts, as shown in Fig. 4, almost spidery in appearance but actually capable of bearing a tension many times over that required. The engine may thus easily be removed and changed in case of trouble, with little loss of time which is an obvious advantage in the carrying of mail.

In many cases the manufacture and assembling of the Bristol "Jupiter" in the shop is a reversion to the days of hand labor. Quantity production is frowned upon. With a force of 160 men, the Bristol Company will consider itself well satisfied to turn out as many as sixty engines during the next year. That, at least, is the production quota it has set for itself, although at this writing the shop is more than one machine behind schedule. Views of the shop are given in Figs. 5 and 7.

Hand Labor in Vogue

Hand labor here, moreover, is hand labor in every sense of the word. Some parts, such as the induction spiral, are so complicated that no machine has been made that can fashion them. Not even a filing machine is used on the spiral, the work of filing it down by hand requiring many hours of painstaking endeavor.

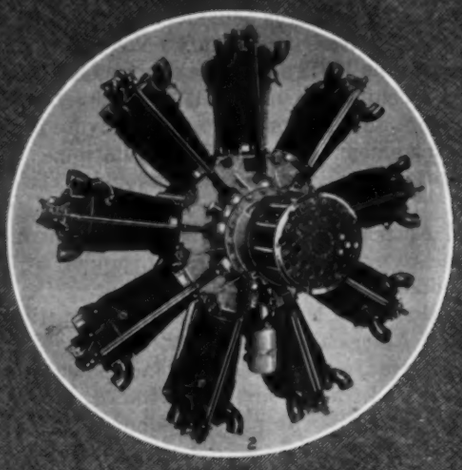
As a matter of fact, the British have had almost no experience with quantitative production in engines. Something in that direction was attempted during the war, but the project lapsed with the fulfillment of wartime contracts. In the automobile field the Rover stands virtually alone as a product of quantity output, but even the Rover total, 300 cars a week, is little compared with the sausage machine production of Henry Ford. From the standpoint of the airplane, day work and handwork are more than sufficient to meet the needs of the moment when even the slowest factories are turning out more planes than they can dispose of. If the prophets are right, however, the time is not far distant when the practical importance of the airplane in commercial life will be more universally recognized. Then a way will have to be found to speed up production; and it is a way that American manufacturers have known for years.

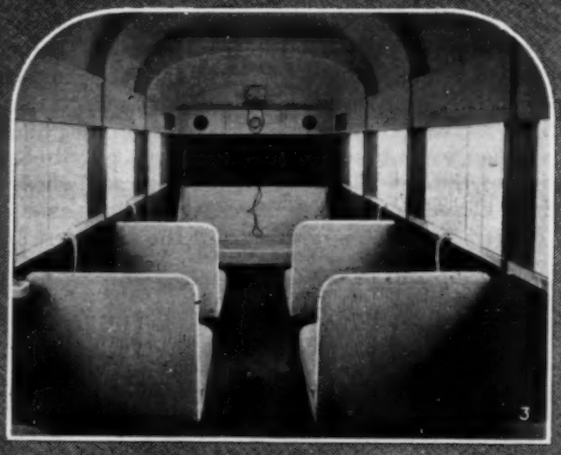
French Manufacturers Get Government Aid

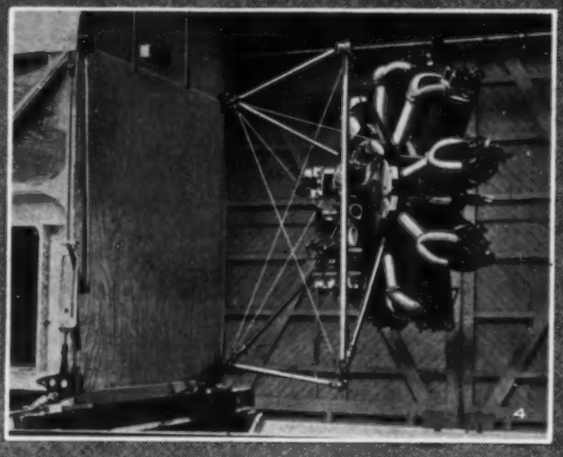
Despite a very real achievement, therefore, British airplane manufacturers may be considered as having gone as far as they can for the present. The air ministry has not given them the support they had hoped for after the war, certainly nothing commensurate with the financial nourishment provided by the French Government for its native industries. This advantage of the French is a bitter pill for British airmen to swallow because of the fact that France is paying practically no interest on her debt to Great Britain, while the money expended in developing her own aircraft industry is approximately equal to the interest she would otherwise have to pay.

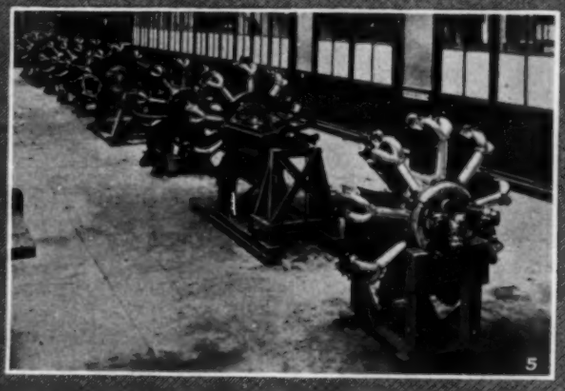
The English position in airplane production was given by Mr. Douglas Vickers, M.P., chairman of Vickers, Ltd., at the fifty-fifth annual general meeting of the company in Sheffield during the latter part of July.

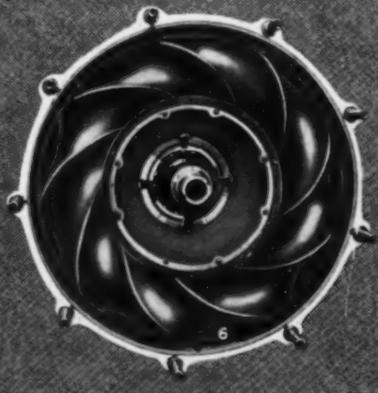
"We are getting our share of such airplane orders as are being placed," he said, "and our type of machines are very successful. But orders come for such small quantities that the cost of designing and experiments bears much too high a proportion to the works' costs of a machine. The position of an airplane manufacturer here contrasts very unfavorably with that of the French manufacturer who gets orders for large series











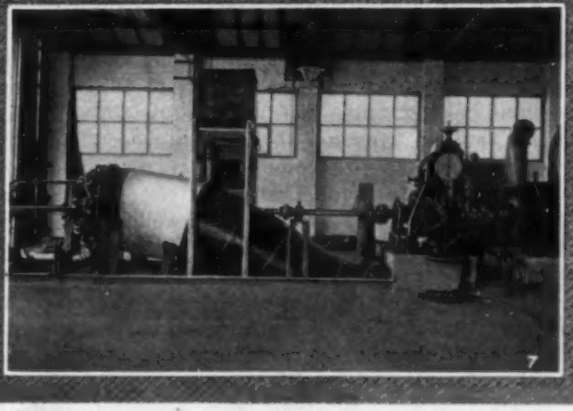


FIG. 1—REAR VIEW OF "JUPITER" RADIAL ENGINE. FIG. 2—PROPELLER SIDE OF "JUPITER" 400-HP. ENGINE. FIG. 3—INTERIOR OF TEN-PASSENGER LIMOUSINE. FIG. 4—ACCESSIBLE FUSELAGE MOUNTING OF RADIAL ENGINE. FIG. 5—RADIAL ENGINES ON ASSEMBLING STANDS. FIG. 6—THREE-START SPIRAL INDUCTION CHAMBER. FIG. 7—TEST BLOCK WITH DEVICE FOR COOLING ENGINE.

of machines and works with much reduced charges and all advantages of repetition work."

The British frankly hope that the next step will be taken by America, which is considered far behind in the manufacture of passenger and cargo-carrying machines. For this reason no little attention was attracted in England by the recent decision of A.H.G. Fokker, the Dutch airplane expert, to abandon Europe and devote his talent to the development of American aviation. If Mr. Fokker's project of establishing a network of aerial lines along the Atlantic seaboard is realized and a sufficient number of Americans are educated to use them, much will be done to overcome the handicap under which the airplane industry of America is laboring.

Incidentally, many British experts, seeming to resent the fact that Americans have ideas of their own in airplane construction, have suggested that American manufacturers can do little better than to import a number of the most recent European models, adopt them "in principle" and continue their experiments from that footing.

The Value of Calculation in Machine Shop

BY W. H. KELLOGG

The following case may serve to show how a little calculation in the making of a tool or any simple device, is a profitable investment in time.

A jig was wanted, low in cost and high in weight. At the same time, the requirements of its use made it somewhat difficult to devise, and it took about two days to work out the design that would cover these points. When the layout was made it was found that the casting for the frame looked rather heavy, so the designer roughly figured its weight by writing all of the dimensions of each rectangular element, and with a slide rule determined the volumes, writing them down opposite each set of dimensions in one column to be added, the whole operating taking about ten minutes.

Then looking at the design again from another angle, a different form of casting was conceived which could be made without changing the principle of the mechanism. In thirty minutes more a rough drawing was made, which was true in outline and fairly close to scale, and from it another calculation was made, the result of which was 43 lb., as against 92 lb. in the first design.

As no detailing work had been done, no loss of time for additional work was necessary in making the change except the forty minutes that was already consumed for the two calculations and the rough drawing. The saving in the cost of the casting more than paid for the time of considering this change, and the result of the work was much more satisfactory as the reduced weight made the tool so much easier to handle.

While such simple facts may seem commonplace, the writer thinks that in calling attention to this circumstance, many other cases will be brought to mind in which no drawing or even a sketch was used. In many such cases it may be remembered that some parts of the mechanism were made that could not be used, as certain points in the design could not well be foreseen, also that considerable time was spent in making these parts as well as trying various ways of doing the work without a definite outline to go by. Probably a few hours at the drawing board and a few additional sheets of paper would have cost considerably less than the time and material used in this way.

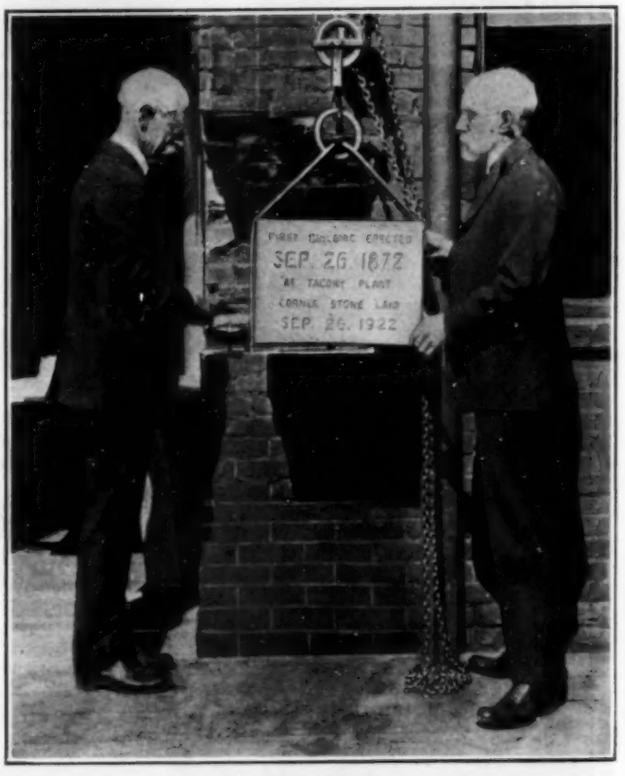
There are few machine shops large enough to employ twenty-five men or more, that could not profitably use a good designer for the purpose of looking into many little problems such as these, even though very little original work is needed. The placing of machines to save floor space, the arranging of the room in the shop or office to save unnecessary movements, the improvement of belt drives to save belting and eliminate friction, the saving of material by changing the design of manufactured parts, and numberless other things of varied kinds can be improved in a profitable way by the simple application of careful thought and calculation.

Laying a Corner Stone 50 Years After

When Henry Disston, founder of Henry Disston & Sons, Inc., needed a new plant in Tacony, Phila., 50 years ago there was no time for ceremonies and ground was broken by Henry Disston, Samuel Bevan, chief engineer, and William Smith, who succeeded Mr. Bevan. Fifty years later, September 27, 1922, the corner stone was laid as shown herewith, by Jacob Disston, Sr. (the only surviving son of the founder), and William Smith, who assisted in breaking ground 50 years before.

Of equal interest, and even more unusual, was the witnessing of the ceremonies by 54 Disston employees who were working for the firm when the Tacony plant was started. The Disston saws date back to 1840 when Henry Disston began, alone and by hand, to make them in a cellar on Bread Street, near Second, in Philadelphia.

The corner stone was dedicated not only to the starting of the new plant but to the veterans whose service had helped to make a success possible, as stated by William D. Disston, grandson of the founder. It speaks volumes for the kindly relations existing in this plant that the number of veterans is increasing year by year. There is something worth while about a plant when men stick to the job year after year.



LAYING THE CORNERSTONE

Building Axles for the Franklin

Some of the Special Tools and Methods Used in Making a Tubular Front Axle and a Combination Steel and Aluminum Rear Axle

By FRED H. COLVIN
Editor, *American Machinist*

ALTHOUGH nearly all builders of automobiles have adopted forged axles of the I-beam type, the Franklin designers still believe that the tubular front axle presents the best answer to the many demands made upon it by the various stresses and road shocks. It is retained even though its cost is probably higher. Methods used in making such an axle are of special interest.

The bending of the tube and the drilling of the spring pads are done by usual methods but the special machines used in drilling for the forks which carry the steering pin are unusual, as shown in Fig. 1. The axle is located by the spring pad at *A* and the forked end is positioned by the steering pin hole at *B*.

The drilling head carries four spindles all driven by a single belt and the drills are fed into the work by means of the pilot wheel *C* acting through the rack and pinion at *D* and transmitting the feed by means of the levers and bell cranks as at *E*. After the drilling, the locating rivets are put in place and the forked ends brazed to the front axle tube. The riveting is shown in Fig. 2. where the tube is held in special vise jaws and the rivets driven by the air hammer *A*, while the plugs *B* act as holders-on.

The assembling of the front axle requires considerable care if good results are to be secured. The assembling fixture, shown in Fig. 3, is very complete and takes care of the steering knuckles as well as the spring mounting. The forked ends are located by the plug *A*, which represents the steering pin and holds the knuckle in place. The full elliptical springs are posi-

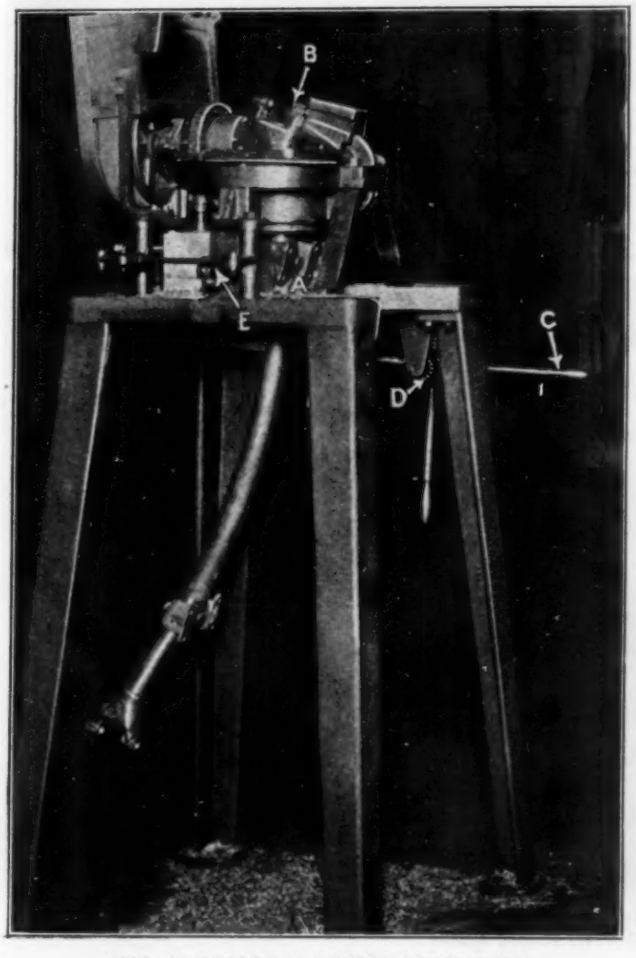


FIG. 1—DRILLING FRONT AXLE FORK

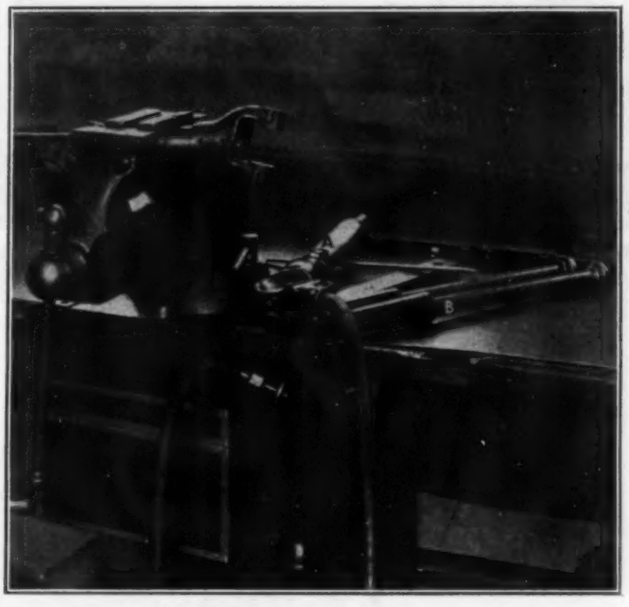


FIG. 2—RIVETING FORK BEFORE BRAZING

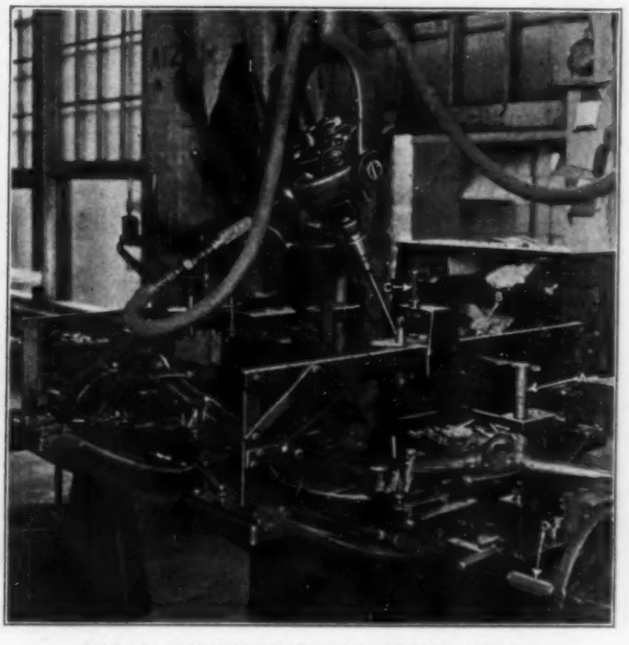
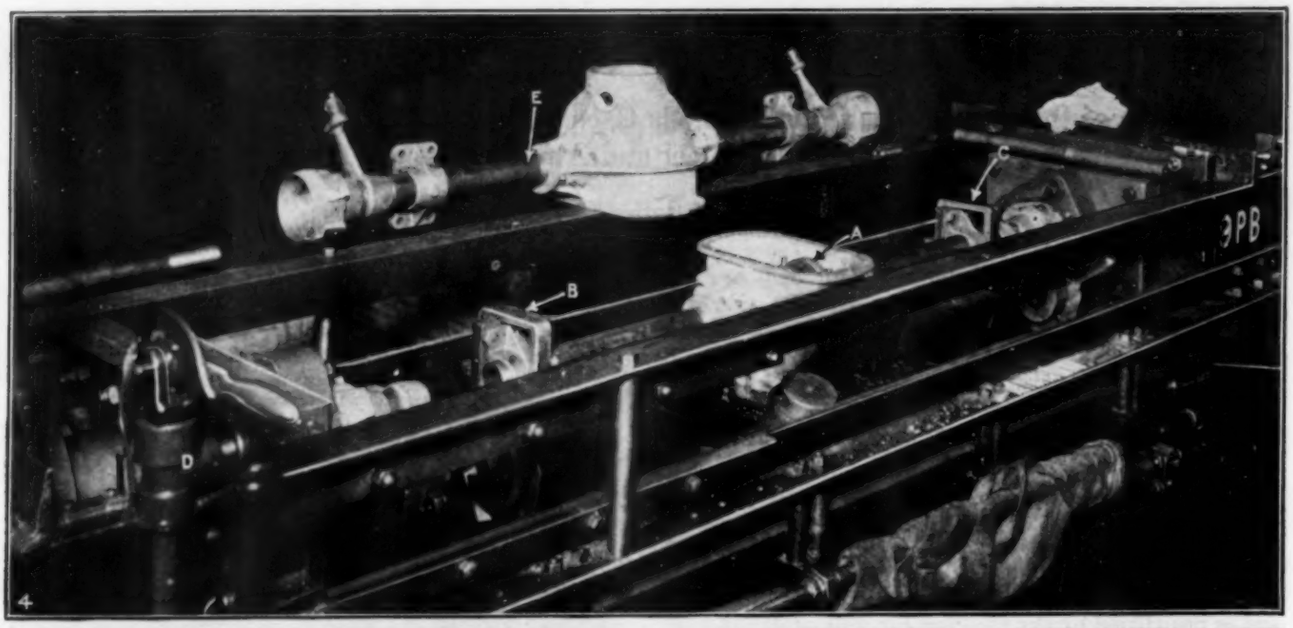
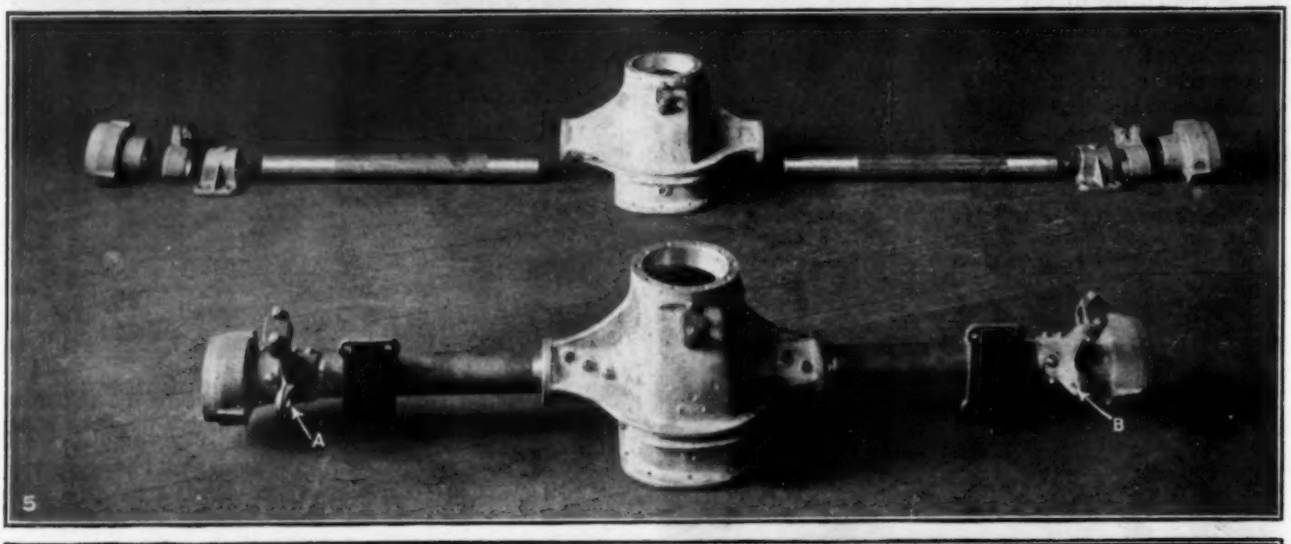


FIG. 3—ASSEMBLING THE FRONT AXLE





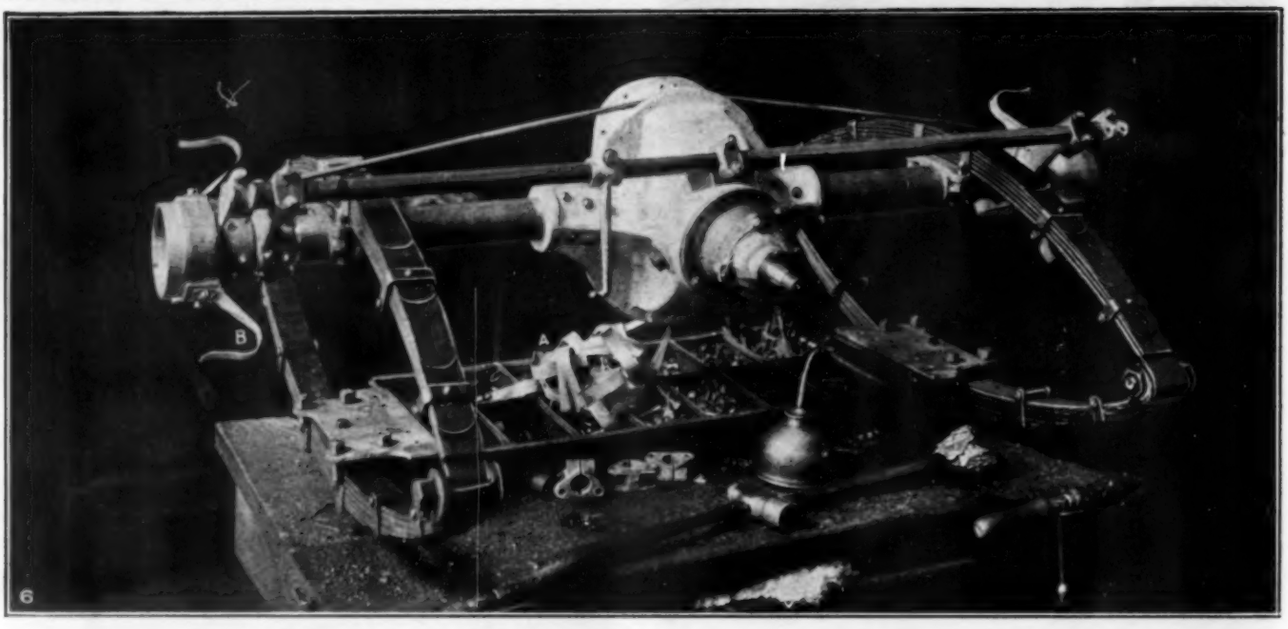


FIG. 4—FORCING REAR AXLE HOUSING PARTS TOGETHER. FIG. 5—REAR AXLE PARTS AND AN ASSEMBLED AXLE. FIG. 6—ASSEMBLING THE REAR AXLE

tioned by the framework *B*. This fixture allows the easy assembling of the top and bottom spring clips, the lower connection being underslung, as can be seen. The upper spring connections are located by the spring plunger at *C*. The projections above the spring are for fastening the springs to the wooden frame which connects the two axles and on which the body rests. The whole fixture is trunnioned on two pedestals so that it can be turned in any convenient position. The indexing pin is shown at *D*. The nuts are screwed into place by an air drill provided with a friction chuck.

The Rear Axle

The Franklin rear axle is also out of the ordinary, as can be seen from its construction in Fig. 4. It is one of the few rear axles made with an aluminum differential case in order to reduce unsprung weight. Into each end of this central casting a steel tube is forced before the final assembly. The press, Fig. 4, forces on the spring pads and the outer castings which carry the rear wheel bearings.

The differential aluminum casting with the tubes already riveted in is first put in the press and a spacing piece, *A*, put in between the walls of the case to prevent distortion while the tubes are being pressed into position. Screw flanges adjust this spacing block and allow it to be easily put in and removed.

The spring pads are placed over dowels *B* and *C* in the fixture and the end pieces located in the two rams at the ends. The valve *D* controls the hydraulic pressure which forces the heads toward the center and with them the various parts which go to make up the rear axle housing. The completed housing is shown at *E* and also very clearly in Fig. 5, including the leather cushions riveted to the spring pads.

The complete rear axle assembly is shown in Fig. 6. Here the drive shaft pinion is in place as well as the brake rigging. The upper spring connection for the frame is shown at the bottom, the axle being upside down with the frame plates resting on blocks on the bench. The tray on the bench contains all necessary nuts, bolts and cotter pins. A small pile of the springs used to keep the brake band away from the drum may be seen at *A* and in place at *B*. This view also shows the truss rod which runs under the differential case and which is anchored at *A* and *B*, Fig. 5.

Personal Records

By A. W. Brown

A card index "Who's Who" should be kept by every manufacturing establishment, giving information concerning each member of the working force from the Grand Panjandrum down. The index should give not merely the usual memos about age, family circumstances, etc., but data concerning temperament, and physical, mental and moral qualities. In other words, the worker should be "sized up" so that if the time comes for laying off men on the one hand, or transferring or promoting on the other, the man's record as to what he can do and cannot do, and what he probably could do and could not do, will enable sane and mutually satisfactory action without great delay. Wages from the beginning of employment, through successive increases or decreases should be entered, with the reason for each change.

Needless to remark, these records should be open for inspection only to certain duly appointed persons, in no case to any of the workers.

A Trial Drill that Made Good

By I. B. Rich

A local salesman had left a new kind of drill for trial in a shop on his "beat" and in due course of time he dropped in to see how it was working out. It wasn't one of these "red-tapy" shops where the salesman sees only the P. A. and the P. A. tells the super and the super tells the general foreman, etc. It was a direct action shop, and the salesman had the confidence of the management to the extent of being able to go straight to the man using the drill.

But the man saw him coming—made a few mysterious passes at the drill spindle and beat it. Pretty soon he came back empty handed.

"How's the drill working, Bill?"

"Fine, don't see how it could be better. Have you come after it?"

"No, Bill, just wanted to see how it worked."

"S'all right then—I'll go get it. Saw you coming, so I hid it—thought you wanted it."

The salesman didn't need to be told how to use this recommendation for his drill.

Sauce for the Goose Is Sauce for the Gander

By Entropy

Draw a circle with a radius of five hundred miles with the office of *American Machinist* as a center, and it will just about pass through a shop that I saw a few days ago where awnings were hung alike over shop windows and office windows. It was such an odd circumstance that I was quite amazed. It has long been the custom to assume that the office force needed awnings on the sunny side and that the shop force did not. From my personal acquaintance I have judged that from a purely physical point of view it may be that the average office worker is less able to withstand heat and cold than the average shop worker, but as a matter of profit and loss to the company I have wondered if there would not be more profit per awning if they were put over shop windows than over office windows.

Of course an awning does not do much good in the middle of the day because then the sun is nearly overhead during the awning season, but on the east side in the morning and on the west toward night there is a good deal of superfluous sunlight coming in. This is either when men are starting the day's work and need to conserve their strength to get through the day, or when they are finishing the day's work and will soldier on the job to get through it with the least effort if they are already tired.

Awnings on the south side, where most put them, are more ornamental than useful. Shop men get tired, they are affected by the heat and they have just as many ways of appearing to keep busy without working hard as do office workers. The profits of the company are much more affected by this slowing down of a shop man than they are by the corresponding slowing down of the office, moreover the shop usually starts work earlier and quits later than the office.

I have sometimes wondered if the managers of these shops did not put up awnings for the offices because they were so ashamed of the rates they pay their clerks that they felt that they must do something to make up this deficiency to them. Perhaps like the fleas on David Harum's dog, the awnings help to keep their minds off their being clerks.

Ideas from Practical Men

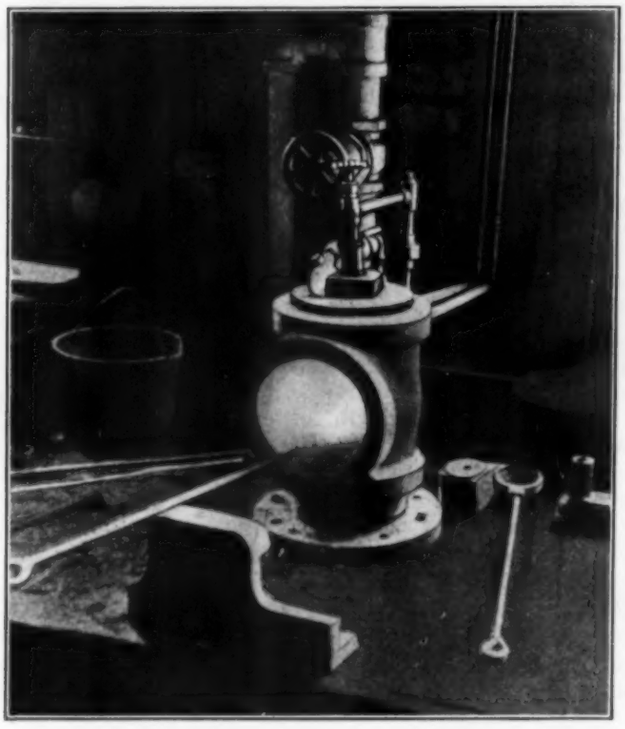
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Small Heating Furnace from Scrap Material

BY MILTON WRIGHT

A furnace in which to heat small dies and other tools for hardening, to melt small quantities of babbitt, for soldering or any of the numerous purposes for which such a furnace is needed about the average machine shop, is here shown. It is made from scrap materials. The body of the furnace is a 4-in. pipe tee that had been discarded because of a crack. A flange and short nipple furnish the base, the nipple being filled with fire clay up to the level of the side outlet of the tee. A plug which is tapped for the burner, closes the top of the tee, and the burner is made from such odd fittings as may always be found around a shop where pipe is used.

The construction of the burner is apparent from the picture. The gas is admitted to the side outlet of the ¾-in. tee while the upper outlet or "run" of the tee is reduced to take the ⅜-in. air jet pipe. The whole outfit can be put together in a few minutes in most any



A HOME-MADE SMALL FURNACE

general machine jobbing shop from material that would otherwise be considered as scrap. None of the joints need be tight and therefore fittings that are distorted or have damaged threads may be used. The size of the air jet would depend somewhat upon the pressure of the supply. The illustration shows the furnace under fire with a ladle of babbitt being melted.

A Handy Boring Machine Attachment

BY W. J. WINSTON

The use of the fixture shown in the photograph, Fig. 1, on the faceplate of a Landis horizontal boring machine, makes it possible to perform several operations that formerly required the services of a planer, lathe and radial drilling machine and has eliminated

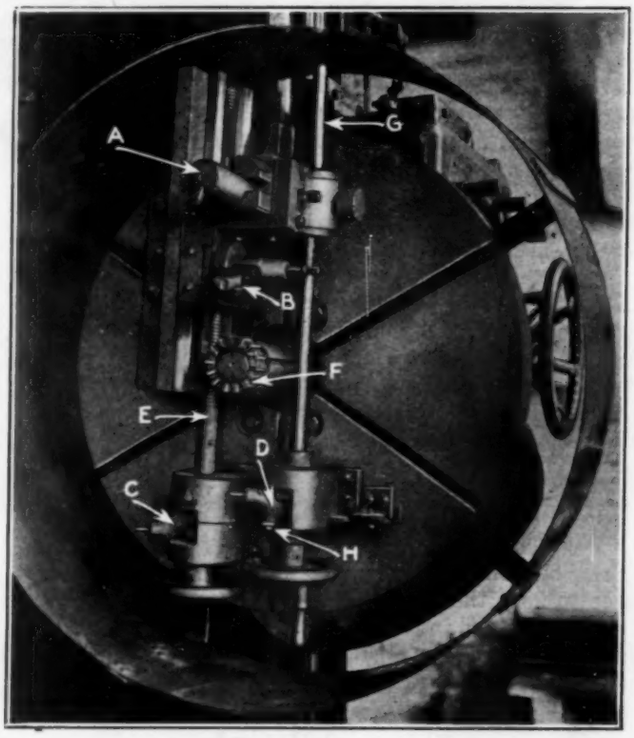


FIG. 1—ATTACHMENT ON BORING MACHINE FACEPLATE

the time and cost of handling the casting between operations.

The casting, a machine frame, is shown in Fig. 2 in the position in which it is placed on the table of

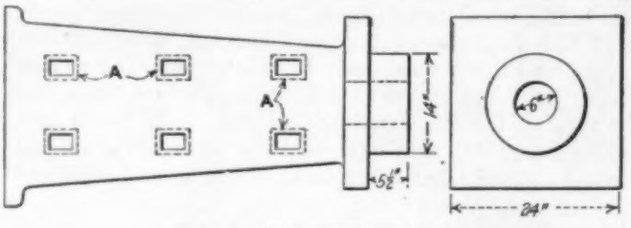


FIG. 2—MACHINE FRAME

the machine. In the first operation, the machine-table is turned so that the side of the frame faces the head of the machine and the inner faces of the bearings *A* are milled off, using a four-inch cutter, shown at *F*, Fig. 1. Then the table is turned to bring the top of

the casting to the head of the machine and the six-inch hole is machined, using a cutter in the spindle *F*, while at the same time the tool *A* is turning the outside of the hub. Then the face of the square and the end of the hub are faced simultaneously, using the cutters *A* and *B*.

When used for turning, the feeding of tool *A* is effected as follows: Shaft *G* passes through a worm that meshes with worm-gear which has a square thread cut through the hub. The tool-bar *A* has a corresponding thread cut on the outside and thus serves as a shaft for the gear. When shaft *G* is turned, the worm gear is revolved and the bar is fed forward. A keyway, cut the whole length of the bar, slides on keys in the worm gear housing and keeps the bar from turning.

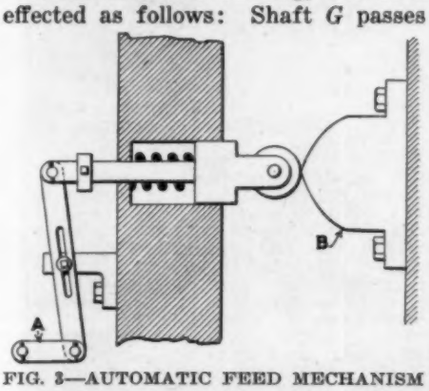


FIG. 3—AUTOMATIC FEED MECHANISM

When ready to perform the facing operation, tool *A* is set the correct distance from tool *B*, and the two tools are fed across the work by the operation of the screw *E*, which passes through a nut on the bottom of each of the tool posts.

Screw *E* and shaft *G* each passes through a gear located at the lower end of the shaft, just above the hand wheel, and connected with each gear is a ratchet of the usual design. Attached to the ratchet at point *H* is the connection *A*, Fig. 3. Through an intermediate lever, this connection operates a push-rod which carries a hardened and ground steel roller. The push-rod operates through a hole in the face plate of the machine, as shown in Fig. 3. A hardened steel block, *B*, is bolted to the column of the machine in such a position that the roller passes over it with every revolution of the face plate, thus operating the ratchet and feeding the tool. The intermediate lever is slotted so that it can be shifted to change the feed.

Formula for Tap Drill Size—Discussion

BY WM. S. ROWELL

I wish to refer to recent contributions in the *American Machinist* under the above head by J. R. Owens, on page 935, Vol. 56, and H. W. Bearce on page 310, Vol. 57. Possibly a little further consideration of this subject may not be overdoing it. The rule: Tap drill = Nominal tap size — $2d$, (d = depth of thread) may be departed from only where less than a full thread is permissible. Doubtless modesty prevented the editor from pointing out that Mr. Owens' variant has appeared in more than one edition of the *American Machinists'* Handbook, and may be found on page 62 of the third and current edition, where it appears with a caution. It is only a rough approximation, giving about 76 per cent of a full thread. Though reasons may be given for the use of such threads, it is well to understand their limitations, and especially to know when we are producing them. The percentage of full thread permissible or advisable in any specific case depends on many factors, including not only service required, but material used, length of thread in relation to diameter, and so forth.

A little examination of the subject will show that the rule under consideration: Tap drill = nominal size — $\frac{1}{p}$, (p = number of threads per inch), would be right if $2d = \frac{1}{p}$; but even in the shortened U.S.F., and similar threads, $2d = \frac{1+0.3}{p}$, very nearly. To be more exact $2d = \frac{1 + 0.2990375}{p}$. For convenience the less than 0.001 may be neglected, and double the depth of U.S.F. threads ($2d$) may be considered, $\frac{1.3}{p}$. Those who are especially interested in reducing power consumption and breakage in tapping operations are inclined to urge the advantages of a shallow thread; but so mony considerations enter into the problem of proper thread depth that most designers and users of taps prefer to decide each case on its own needs.

A rule for quickly and easily approximating tap drill sizes for any U.S.F. tap is: Tap drill = nominal tap size less $\frac{1.3}{p}$. This rule is submitted after use extending over many years. It also "has never been seen in print" nor has it been found in use by the writer. It may appear to some that 1.3 is an inconvenient mixed-number to use as a dividend; but most of that disappears when reduced to $\frac{1,300}{1,000}$. It is always considered either $\frac{13}{10}$, $\frac{130}{100}$ or $\frac{1,300}{1,000}$; usually the latter, as most of our dimensions are in thousandths. A pencil is never used in the calculation, the mental process being something like this: Take a ¾-in. 10-thread tap drill:

$$1,300 \div 10 = 0.130$$

Nominal size = 0.750 in. — 0.130 in. = 0.620 in. = aproximately ⅝ in.

It is instantly seen that ⅝ in. is slightly large but as generally agreed we rarely need a *full* thread. This is an easy one. Now for one that may look less so. A one-inch 8-thread tap drill = 1,300 ÷ 8 = 0.1625

Nominal size 1 in. — 0.1625 in. = 0.8375 in. = ⅞ in. approximately.

Here again in selecting a ⅞-in. drill we are sacrificing a small amount of thread depth.

Even in the case of a fractional thread a pencil is scarcely needed in the simple calculation

Example, 5 in. 2½ threads.

$$1,300 \div 2\tfrac{1}{2} = 0.520$$

Nominal size 5 in. — 0.520 in. = 4.480 in.

It is readily seen that the only noval feature of this rule is considering the constant 1.2990375 as 1.3 and this as thirteen-tenths or a hundred and thirty hundredths or thirteen hundred thousandths, preferably the latter as so much of our work is dimensioned in thousandths that we all become more or less familiar with that tiresome translation of binary and other vulgar fractions into their nearest equivalents in three places of decimals. The burden of ten as a radix is one that man may never escape. May it be considered evidence of a slight oversight in the original design, starting him out with ten digits instead of eight, or better, twelve?

String Board Graphics—Discussion

By H. E. Taylor
Chief Engineer, Hotchkiss & Co., Coventry, England

The contribution of Percy S. Brown on string board graphics which appeared on page 483, Vol. 56, of *American Machinist*, has been read with interest.

Visual recording in its works has been adopted successfully by Hotchkiss & Co. As the string graphs have been in operation for nearly three years, a few remarks on the details of their application to the progress section may be of timely interest.

The boards used, a sample of which is shown in Fig. 1, are of simple, cheap construction, standard as to size and painted black. The titles and borders are carried out in white enamel, and light green paint is used in dividing the board into squares.

The names of the components with their corresponding drawing numbers are painted on black enameled strip plates. Each plate is drilled at the ends and can be hung on two nails provided on the board for this purpose. These plates were adopted to enable alterations to be made quickly. In the center of each square, a short brass nail is driven, and around these pegs the string is carried as shown in the illustration.

Various colored strings are used. A red string stretched from the top to the bottom of the board, shown by the dash line, is used to indicate the nominal stock which should be carried. The actual stock in the stores is indicated by a white string. A yellow string is used to show the number of parts actually passing through the shops at the time the boards were last made up.

To the extreme left of each board, a strip of paper is carried on "bulldog" clips. Upon this strip of paper, each time the boards are made up, is entered the number or quantity by which any component falls short of the nominal stock quantity previously arranged. In the case

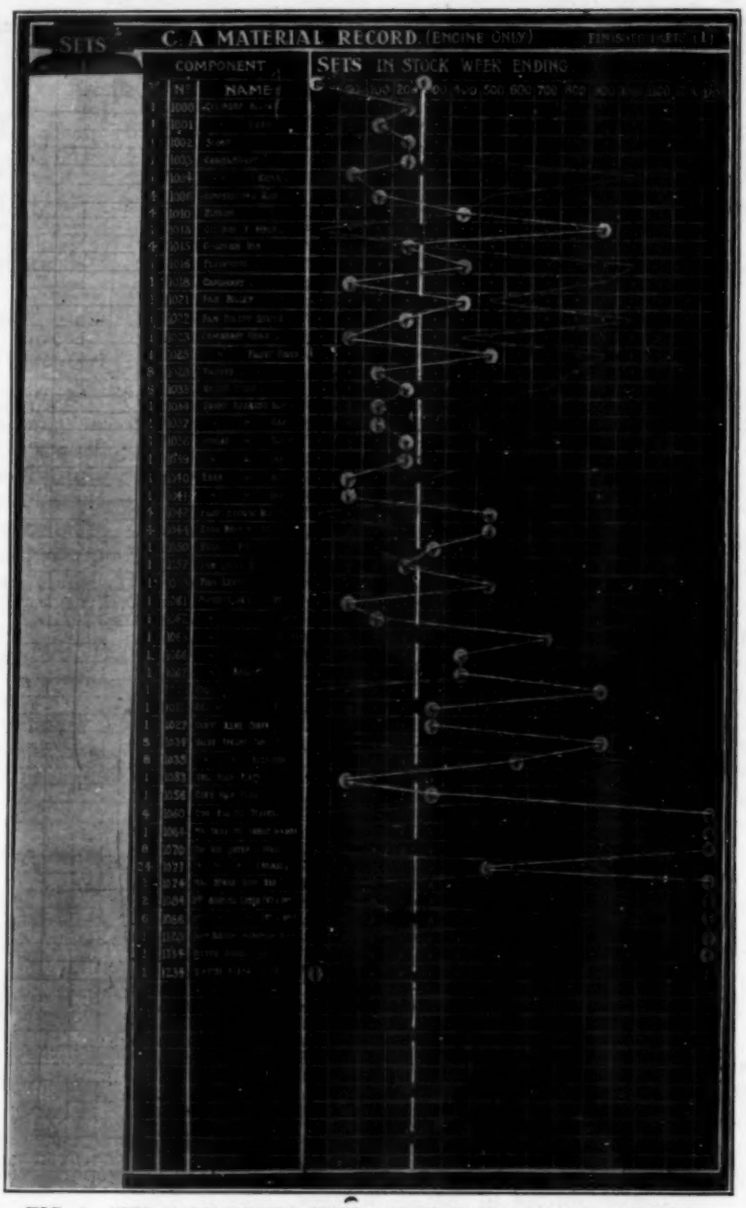


FIG. 1—STYLE OF BOARD USED, STRING GRAPHS IN POSITION

FIG. 2—STRING BOARDS IN OPERATION IN FINISHED STOCKROOM

of a shortage, therefore, the department concerned understands that it should endeavor to make up the quantity lacking before the boards are brought up to date again.

Three sets of boards are used. One gives the position of the raw material stock. The second board shows the parts purchased from outside sources in a completely finished condition; and the third board, by means of different colored strings, indicates not only the quantity of finished parts actually on hand in stores, but shows details pertaining to the progress of parts in manufacture in the shops.

The boards are brought up to date weekly. The "rough storekeeper" is responsible for the raw material records, and the progress department for parts passing through the shop. The "finished storekeeper" is responsible for parts bought outside, as well as finished stock. In cases where any component or part requires special attention, metal stars are used, and these are hung on the pins around which the strings are carried. In Fig. 2 a number of the boards are shown in operation in the finished stores department.

Automatic Machines for Small Brass Gear Blanks

BY HERBERT CRAWFORD

The Neptune Meter Co. uses many small brass gears in the recording mechanism of its meters, and the two machines shown herewith have been rigged up especially for machining the blanks. The first is a small, special automatic machine, shown in Fig. 1, for turning the outsides. The castings are dumped into the hopper and slide down against the feeding disk *A*, which revolves slowly. The slots in the face pick up the castings and the outer piece in each slot drops through a chute at *B* to the feeding plunger *C*. The two holes to be seen in the gear blanks fit over corresponding pins on the plunger which hold them against turning, while the plunger feeds the blanks into a hollow mill which turns the outside. With the withdrawal of the plunger the finished piece drops out of the way and another takes its place. The machine requires no attention except to fill the hopper.

The second operation is performed on a Brown & Sharpe automatic screw machine, as shown in Fig. 2. The turned blanks are fed into the S-shaped magazine and roll down into the receiving head *A*. The tool *B* pushes them into the chuck by means of the plunger *C*. While the turret is turning, the rear cross slide with the plunger *C* is drawn back out of the way and the drills in the turret get to work. The center hole is drilled and reamed and the side faced by the front tool carriage, after which the piece is ejected from the chuck and a new piece fed into place.

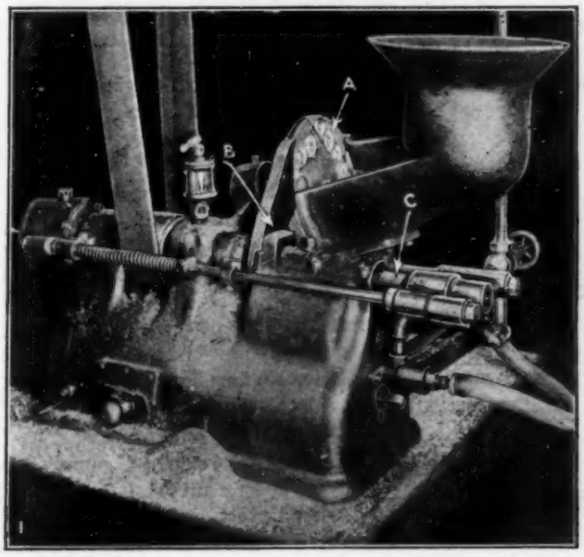
Another evidence of the way in which dial indicators are used can be seen at the left of the cross slide. These indicators are mounted in various ways so as to be convenient for the operator to test as many pieces as may be necessary as they come from the machine.

The Mechanics of Drafting

BY V. P. MENDENHALL

While a draftsman is not judged solely by the quantity of his output, there are certain mechanics of the profession which can be arranged to shorten the time consumed in detailing and allow more opportunity for the draftsman's training, experience, and other factors of ability to assert themselves. In making an assembly, or construction drawing there is very little opportunity for short cuts. The group assembly method, however, has many advantages on all but the simplest machines. When each unit is treated separately, the drawing can be made on a larger scale, there is not so much hidden mechanism, the sheet does not become so soiled, alterations do not affect details already approved, and, if desired, more than one draftsman can work on the same design.

With an accurate assembly, the following method of detailing will be found productive: The standard detail sheet is printed on the dull side of the tracing cloth. A backing sheet of detail paper is put on the board and the sheet outline, block divisions guide lines for such lettering as symbol, material, and number required, are printed in pencil. The tracing sheets are laid on this backing sheet one at a time, dull side up, the details outlined with a soft pencil and immediately inked in. The block outlines help to place the drawing, and the division lines are inked in as necessary to



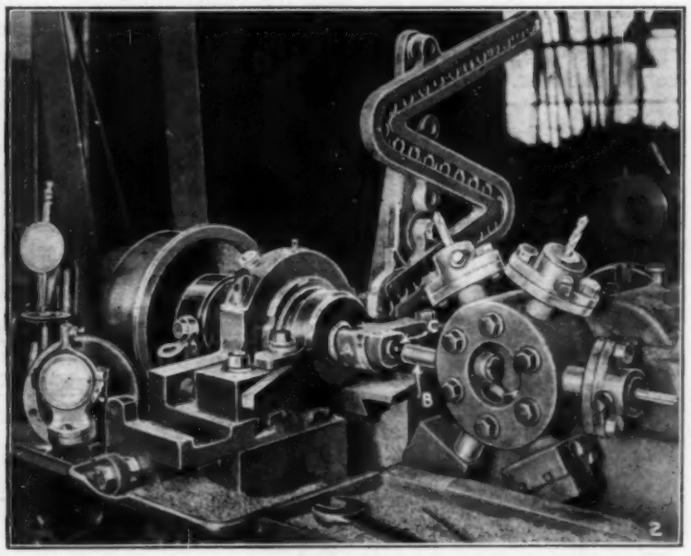


FIG. 1—SMALL AUTOMATIC MACHINE WITH HOPPER FEED. FIG. 2—MAGAZINE FEED ON BROWN & SHARPE AUTOMATIC SCREW MACHINE

enclose each detail. The sheet is then cleaned with gasoline. A draftsman who is accustomed to think ahead of his hands can show a noticeable increase in the work accomplished by this plan, especially if he is provided with a drafting machine.

One view will suffice for most of the studs and pins, as well as for flat plain work if the thickness is given in a note. Gears, pulleys, rollers, and bushings need only a cross-section. A left hand view or symetrical half can often be traced from the right hand printed face down. Fits should be given in thousandths. In the shop $(1\frac{5}{8})+2$ to $2\frac{1}{2}$ will prove a great time saver over $(1\frac{5}{8})^{D}$. For springs, the size of stock, mandrel and turns per inch should be given.

A great aid to the production clerk is a parts list of each machine giving the symbol, part number, sheet, number required, material and stock needed, and in what shape, that is, cut up, or in bar form for turret lathes and screw machines. Stock patterns for bushings are also noted. In addition, the assembly will be greatly accelerated by a bolt and screw list, including all the parts to be drawn from the supply room. Such lists will insure that the different parts and materials are ordered well in advance of assembly, and will go far towards standardizing methods of production.

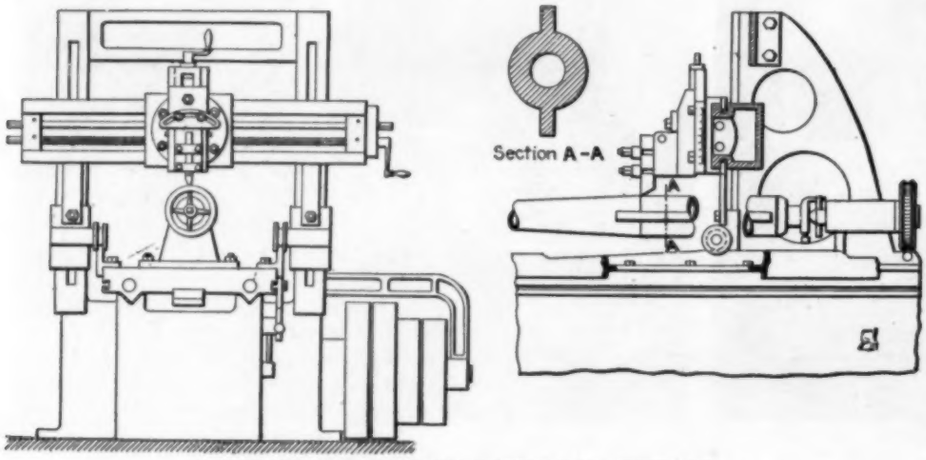
Planing Irregular Surfaces

By Joe V. Romig

Work having complicated surfaces—circular and flat, having more than one plane, or having a flat surface merging into a long taper or radius—can be machined on the planer by means of the simple equipment here described. The use of formers for producing multi-surfaced rounds in the lathe is common but the attachment of a forming device to a planer is unusual.

The example shown is that of a light cannon having on each side a parallel rib or shear forged in one piece with the jacket. The shears are for the purpose of mounting the cannon in the housing in such manner as to permit it to move endwise, and are a part of the recoil absorbing mechanism.

The body of the gun is round, parallel over a part of its length and tapered the rest of the way. To finish this surface by turning would have been impossible, as a glance at the section A-A will readily disclose. The forging was machined upon a planer in the manner herein described.



SET UP FOR PLANING IRREGULAR SURFACE

Cast-iron former bars of T-sections were made as may be seen in the sketch, and one of the internal angles planed on each so as to allow the bars to be bolted rigidly to the table. One edge of one of the T-s was then laid out to conform to the contour of the finished gun, and both were planed by bolting together, gripping them in the shaper vise and planing crosswise. Several hitches were necessary to complete the long bars but no real difficulty was encountered in following the line.

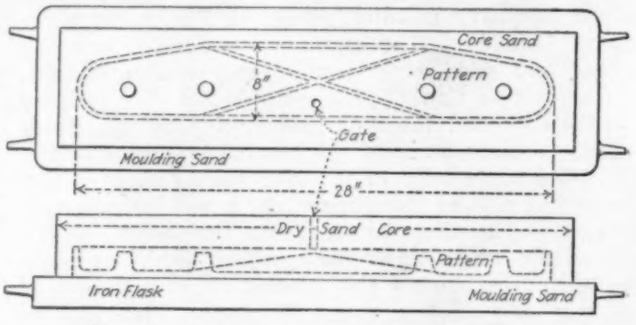
The former bars were then bolted to opposite sides of the planer table. Slides, each carrying a guiding roller, were fitted to the face of the planer housings and attached to the crossrail by suitable straps. The elevating screws were removed to allow the crossrail to rise and fall as the rollers traveled over their respective formers.

A pair of centers to take the work completed the set-up and the work of machining was simple and easy of accomplishment.

Making a Straight Casting from a Twisted Pattern

By M. E. Duggan

Dan Mulligan had money and was looking around for an easy way to get rid of it, so I advised him to try inventing. He did—and proved that this long-advertised method was not always successful. Dan



A GOOD CASTING FROM A POOR PATTERN

invented a machine for taking the wrinkles out of trousers. Being a novice in the art of spending money he could not grasp the idea of paying out enough all at once to get a good set of patterns for his experimental machine so he compromised by having a "good enough" set made, from which he obtained the castings for one machine. The patterns were then "parked" next to the roof of the pattern loft where the boiling sun poured down day by day—unless it rained, when the roof leaked a little. No further attention was paid to the patterns, however.

The first machine was an astonishing success, much to everybody's surprise, and Dan immediately ordered castings for six more, but alas! those patterns from which the first set were made so nicely were

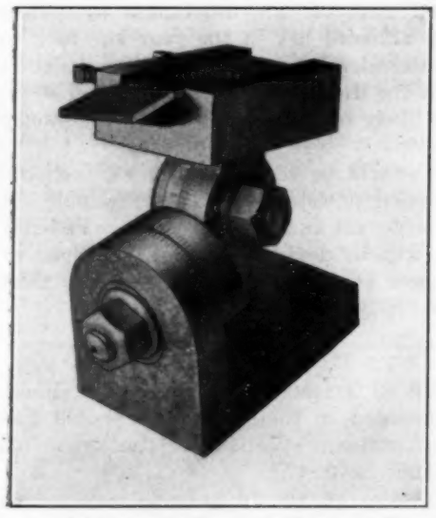
no longer in condition to produce others of like degree, for they were warped, twisted and some of them broken beyond repair. One of the castings was for a sort of steam table and required a true flat surface, for the finish was by grinding and there was no stock to be machined off. Here is the way we made a good casting from that twisted pattern.

The pattern was laid face down on the core bench and a rough frame of wood nailed around it as a sort of temporary flask. This was filled with core sand and, when ready, this "core" was put into the oven and baked. An iron flask of suitable size was then provided and partly filled with molding sand, rammed down good and hard and the surface swept off level and smooth. On this bed of molding sand the "core" was laid, still face down, and weighted. The iron was poured through a hole or gate that had been made in the core, and a good casting resulted, the upper face (which was at the bottom of the mold) being produced by the smooth bed of molding sand. The cut will make the procedure plain.

An Angle Grinding Fixture

BY HENRY M. CLARY

The fixture shown in the photograph was designed for the purpose of holding tools similar to the one shown in the illustration while they were being shaped and ground. It has, however, been found very useful for grinding angles on all sorts of work. The fixture is very simple, consisting of three parts bolted together. The surfaces at the joints are ground even and graduated in degrees, so that a piece of work can be set at the exact angle desired, in either direction. Two setscrews in the head hold the piece in position. The fixture is in use in the shops of the Midwestern Tool Co., Chicago, Ill.



AN ANGLE GRINDING FIXTURE

Safeguarding Shaft Couplings

BY WM. J. FISHER

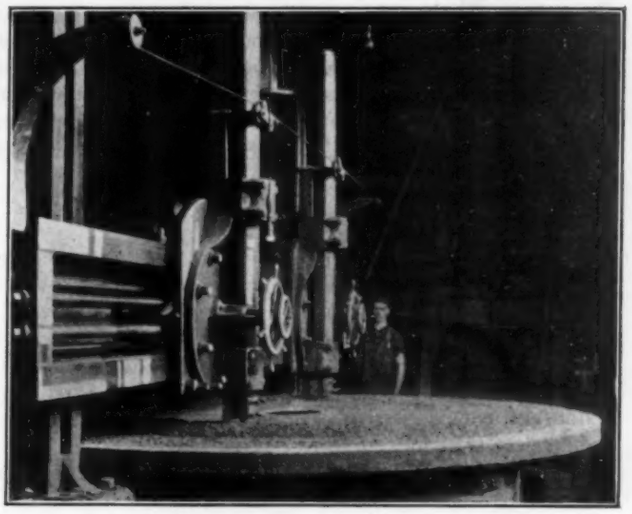
I was interested in an article by E. Hoke, on page 75 of *American Machinist*, on safeguarding shaft couplings. As I am interested in all safety appliances I read it over very carefully.

I cannot understand how the coupling could get by the inspector with that wicked looking gib-key standing out beyond the hub where it would surely catch anything more quickly than the bolt heads and nuts. Why should the key not have been fitted up from the inside, or flange end, of the coupling and cut off flush with the outside hub?

A Single Casting That Is in Two Parts

BY SANDY COPELAND

There is nothing unusual about the job or the casting shown in the illustration except in the way in which the latter is poured so that it may be machined as a single casting and shipped in two pieces. The piece is a "rubbing bed" used for surfacing large blocks of stone, and when mounted upon the machine for service it is bolted to a spider that is in turn keyed upon the end of a vertical shaft so that the disk revolves in a horizontal plane, just as it does on the boring mill only considerably faster.



A SINGLE CASTING MADE IN TWO PARTS

The finished disk is 13 ft. in diameter by about 3 in. thick and the casting weighs 10,800 lb., about 800 lb. being removed by the tools. As shown upon the table of the mill there are two tools at work, each taking a cut $\frac{3}{4}$ in. deep with a $\frac{5}{32}$-in. feed. When the mold in which it is to be cast is finished, and before lowering the cope to place, a wrought iron bar of rectangular section is laid across the diameter of the mold. This bar is $\frac{1}{2}$ in. thick and of a width equal to the thickness of the casting. It has six or eight $1\frac{1}{2}$ in. holes through it and is laid edgewise in the mold.

BINDING THE PARTS TOGETHER

After closing the mold the iron is poured from both sides simultaneously, the molten metal passing through the holes in the bar and serving to bind the two parts together in a single casting strong enough to withstand any shocks that may be imposed by ordinary handling or in the machining operations. When the disk is finished it is mounted upon the spider and fastened thereto by bolts passing up through the spider and tapped into the under side of the disk. After assembling the machine and making sure that every thing is in shape to run, it is dismantled for shipment.

The disk, which thus far has remained a single casting, is then picked up by the yard crane and dropped upon a timber laid upon the ground lengthwise of the joint. One drop from a height of but a few inches is usually sufficient to break the casting. Upon reaching its destination the disk is reassembled in the machine, the bolts passing through the holes to which they were numbered in the original assembly, and the disk runs as true and smooth as when it came off the boring mill,

Editorial

THERE ARE several very important facts about tools that everyone should know, among them three that can and should be proclaimed from the housetops by the men who have learned them through sad experience, for there are still many who do not know them. Machine tools are an asset; small tools are an expense; improper tools are a liability.

Shall We Cancel the War Debts?

TWO NOTABLE contributions to the best thought on the problem of liquidating the debts of the World War were made at the banker's convention last week. Rt. Hon. Reginald McKenna, former British Chancellor of the Exchequer and a noted banker and economist, gave a picture of the situation which rivals in clarity of vision and conciseness of expression any presentation of the subject that has come to our notice.

Mr. Lamont of J. P. Morgan & Co., as one of the foremost American financiers, introduced a more idealistic tone into his address but showed that he has the same keen appreciation of the fundamental problems of inter-allied indebtedness and the reparation indemnities as has Mr. McKenna. He asked many questions and answered some of them by inference only, but in a way that left little doubt as to his personal feelings.

One question, perhaps the most vital one, was this: Should any part of the debt of the allies be cancelled by the American taxpayers? In seeking an answer to this question more than one phase must be considered if the result is to be sound and lasting. Altruism cannot overlook hard economic facts, and political expediency must respect moral principles. The question is so complicated that a hasty answer is inconceivable.

Mr. Lamont says the question of cancelling part of Europe's debt to us must be answered by the taxpayers. What, then, will be the answer of the makers and users of machinery? If they concede that Mr. McKenna is correct in saying that the debts can be paid by exportable surplus only, and they must concede it eventually, most of the available gold and securities being already in our hands, are they not faced with the choice of either agreeing to the cancellation of part of the debt or acceptng payment in machine tools, printing presses, looms and other machinery?

As a matter of fact it seems likely to be something of a Hobson's choice, for, of all the countries of Europe that are in our debt, England is the only one which has the slightest chance of meeting either interest or principal payments, at least within the immediate future.

We Americans would be the last people in the world to doubt the good intentions of our debtors to repay in full, but the laws of economics make small allowance for the best intentions. Until the number of unbalanced national budgets is considerably reduced, we as creditors must discount good intentions about ninety-nine per cent.

Not a few believe that cancellation of all debts of European nations to the United States would make for a rapid return to prosperity for all concerned. They use the argument that so long as we shall probably never be paid anyway, we might as well make the best of a bad matter and start afresh. Others insist that the debits be kept on the books until some means of payment is found. Some of them refuse to believe that Europe is not hiding her resources and is not attempting to "do" us.

We believe that both camps of extremists are wrong and that both ignore basic facts. Those who favor cancellation forget that the mistakes of the Peace Conference have left many sore spots in Europe that are likely to break out if the threat of insolvency is removed. The suspicious and practical souls, on the other hand, are shutting their eyes to the unbalanced budgets, depreciated curriencies, unemployment, lack of capital and raw materials and disorganized industries, some or all of which afflict our debtors.

But isn't there a middle ground that America can take with some hope of improving the situation? Can she not charge off part of this indebtness in return for the protection afforded her in the year she took to raise and train her armies, but at the same time insist on holding to account for the remainder those of her debtors who would be likely to start new wars on the money they owe us.

Just what part should be cancelled and what should not is a very important detail to be worked out. It would vary with different countries perhaps. Possibly some better plan will be devised. But in the light of the information now available this one seems to meet the requirements fairly well.

Just Suppose

JUST SUPPOSE all the modern machine tools should suddenly disappear, and in their place we should find the much admired museum specimen of the "good old times." What would happen?

Well, for one thing, we should have to quit riding in automobiles for they would be in the same class as seagoing steam yachts and pearl necklaces. Nor would the bicycle be within reach of any but a favored few and so we should have to huddle together in cities and say farewell to our suburban home, our vegetable garden and our flower patch. Street cars? No, not even street cars, except a few short-haul horse cars, because motors would be scarce and expensive. Besides, it would be difficult to build generating stations and transmission lines for a reasonable amount of money.

All the people engaged in the making, maintaining, selling and running of these devices would have to go back to the farm and live the simple life, for the farm would be what it used to be—without labor saving devices, or means of communication with one's fellow beings, except with the aid of old Dobbin.

Without modern machine tools we would—

Hold on, this sounds like a nightmare, and besides we have them.

Yes, but—

Just suppose.

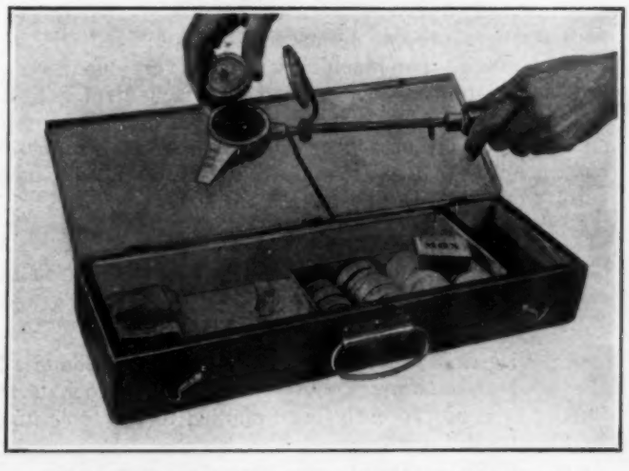
Shop Equipment News

Soldering Iron Heated by Chemical Action

A soldering iron which employs no heat from an outside source, but utilizes chemical reaction to bring it to proper temperature for use has been brought to this country by the International Sales Co., 921 Southern Building, Washington, D. C. In the use of the iron, a chemical transformation is employed by which it is possible to obtain a degree of heat of approximately 3,000 deg. C. in a few seconds. This chemical action has been so applied that by using an accurately measured quantity of the reacting substances the soldering iron can be heated in 7 sec., it it claimed, to a point where it is ready for immediate use.

The soldering iron has a receptacle cast in it, as shown in the illustration herewith. In this receptacle is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening in this container, or briquet, and the wooden portion is broken off. A perforated lid is then closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this one application lasts about 10 min., after which another charge can be lighted and the operation continued. After the first heating, the duration of heat under one charge is increased 50 per cent, it is stated.

The iron and a supply of the briquets and matches are housed in a metal-lined box, with a hinged lid and handle for carrying. The charge can be set off in the

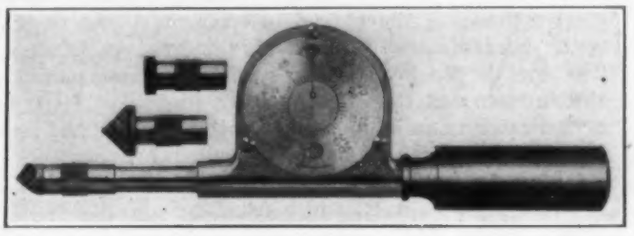


SOLDERING IRON HEATED BY CHEMICAL ACTION

box in a house or room with no danger from sparks, and practically no smoke. While in use there is no flame, but only a glowing mass within the receptable. Owing to the absence of the fire hazard, it is claimed that the iron may be used about the garage, shop or house or on an airplane, automobile, or motor boat with entire safety. The outfit is particularly useful for making quick repairs.

Brown & Sharpe No. 748 Speed Indicator

The accompanying illustration shows the speed indicator No. 748 that has recently been placed on the market by the Brown & Sharp Manufacturing Co., Providence, R. I. The indicator determines and registers the number of revolutions of shafting, motors and revolving parts in either direction, and measures both



B. & S. SPEED INDICATOR NO. 748

high and low speeds equally well. In design this indicator is entirely different from the former models. It has few parts, and is simple and reliable in operation. The readings are taken from one side of the indicator. The device can be quickly set at zero.

The indicator registers up to 5,000 revolutions by steps of five revolutions, although speeds much faster than 5,000 r.p.m. can be determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation. The figures showing through the small round windows on the dial register steps of five revolutions directly. The small inside dial registers hundreds of revolutions. This latter dial can be turned to zero by the knurled knob on the back of the indicator.

The fiber handle serves as an insulation for the operator against electricity. The working parts are enclosed in a dull-nickeled case. Three points are furnished as shown, a steel point for ordinary speeds and rubber points for high speed. All unnecessary projections, rough edges, and corners which might interfere with the use of the indicator have been eliminated. The device is light and easily handled.

Norma Minimeter

On page 861, Vol. 55 of *American Machinist* there appeared a description of the Hirth minimeter placed on the market by the Coats Machine Tool Co., New York, N. Y. The Norma Company of America, Arnable Ave., Long Island City, N. Y., is now manufacturing and selling the minimeter, which is similar in design and construction to that previously described and illustrated. The device is intended for use in gaging, and measurements as small as 0.0001 in. are commercially obtainable. The instrument can be mounted in a variety of ways to suit it to a variety of measurements, both internal and external. Either inch or millimeter dimension scales can be furnished.

Nilson Kritiscope for Determining Critical Points in Steel

A device called the Nilson Kritiscope has recently been placed on the market by Herman H. Sticht & Co., 15 Park Row, New York, N. Y., for use in determining the critical points when heat-treating steel. These points or arrests that occur while the part is being heated can be detected magnetically, as it is a property of steel to lose its magnetism as soon as the lower arrest is reached and the rearrangement of the structure occurs. Thus the Kritiscope is brought near the work in the course of heating so that the point at which the magnetism is lost can be determined.

The accompanying illustration shows the device being brought in contact with a piece of work in a furnace, but it can also be used when a small part is being heated over a flame such as a bunsen burner. As the steel approaches cherry red in color, it should be tried with the indicator until no magnetic effect is shown. The tool is touched to the steel when first placed in the furnace and then drawn away slightly. If the bar or indicator remains in contact with the work, the latter is still magnetic and requires further heating.

The indicator that actually touches the heated piece is itself not a magnet, and hence can be heated without injury. This indicator receives its magnetization by induction from a permanent magnet located within the body of the Kritiscope. The walls of the body protect the magnet from over-heating, so that it always retains its magnetism. The Kritiscope is packed in a wooden

KRITISCOPE FOR DETERMINING CRITICAL POINTS

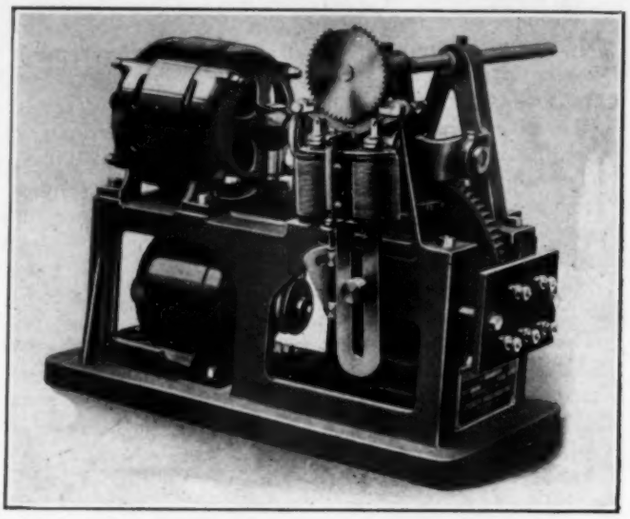
case and is furnished complete with extension rods and a shield for protecting the hand of the operator.

It should be noted that the temperature of the piece itself and its critical points are indicated by the use of the Kritiscope and not the temperature existing in the furnace, as is usually recorded by a pyrometer. The device does not require calibration and is not affected by vibration or rough handling. The Kritiscope is self contained and has no electrical leads or connections. It can be read quickly and directly to ascertain the condition of the steel and the proper time for quenching it.

Engelhard Automatic Temperature Regulator for Gas Furnace

On page 1015, Vol. 52, of *American Machinist* there appeared a description of an automatic temperature regulator made by Charles Engelhard, Inc., 30 Church St., New York, N. Y. The device has recently been redesigned, so that it appears as shown in the accompanying illustration.

The principal changes lie in the addition of a generator to provide the low-voltage current that was for-



ENGELHARD AUTOMATIC TEMPERATURE REGULATOR

merly supplied from an outside source such as a storage battery. The generator is run by a motor operating on current from a lighting circuit. The position and arrangement of the solenoids have also been changed. A terminal board has been added at the end of the frame, which also is of changed design.

The device is ordinarily connected by means of chain to the valve on the gas pipe feeding the furnace. It is connected electrically to a pyrometer, so that the furnace temperature can be ascertained and held within a certain range. The machine itself has three main parts, the motive power, the escapement mechanism and the timer. The motive power consists of a $\frac{1}{12}$-hp. motor operating on either a.c. or d.c., a worm gear reduction having an 80 to 1 ratio, and a 25-watt, 6-volt, d.c. generator to furnish the power for the solenoids.

Plumb Take-Up Wedge for Hammer Handle

A device that provides for retightening the handle in the head of a hammer, hatchet or similar tool of the impact type has recently been applied to the tools made by Fayette R. Plumb, Inc., Philadelphia, Pa. This device, which is designated as a take-up wedge and is shown in the illustration herewith, consists of a tapered screw having uniform pitch throughout its length. A slot in the butt end of the screw enables turning by means of a screwdriver.

PLUMB TAKE-UP WEDGE FOR HAMMER HANDLES

Hickory is ordinarily employed for hammer handles

because of its toughness and springiness, although it shrinks with age and becomes loose in the head. The advantage of the take-up wedge is that not only can a handle be made tight when it is new, but it can always be retightened, so as to keep it tight in service.

To fit the screw to a tool, a hole is drilled in the end of the handle somewhat deeper than the length of the screw. It is then reamed to receive the screw, which is driven in until the butt end is flush with the handle. If the head becomes loose in the handle, a slight turn of the screw again spreads the wood uniformly so that it grips in its socket and removes the looseness. The screw thread prevents the wedge from flying out under shock.

Simplified Cost Accounting

BY ROBERT BRAINERD

The value of cost records has never been appreciated as keenly as in these days when a difference of a few cents on the cost sheet is often the difference between industrial life and death. Many and diverse are the systems in use, but for the small shop, the writer has failed to see a method of cost-keeping that fills the bill any better than that in use by the Saginaw Stamping and Tool Co., Saginaw, Michigan.

When an order is received for a job, a shop order is made out in duplicate, the original of which is sent to the shop superintendent with the blueprint for the job. The shop order number is marked on the corner or back of the print, which is then passed on to the foreman, and ultimately, to the workman.

At the same time that this is done, the shop order is entered at the top of the cost sheet, as are the name of the firm from which the order was received, its order number and the date the order was received. The illustration shows the cost sheet in reduced size; full size is 8½x11 inches.

Each of the workmen who performs any labor on this job copies the shop order number on his clock card, and each day the amount of time spent on the job is recorded on the cost sheet. When the job is done, the total labor cost is entered in the last column opposite "total labor." Any material used on the job is entered on the shop order in the superintendent's charge, and on the completion of the job this is turned in to the office and the items transferred to the cost sheet in the proper locations. Ten per cent is added to the total cost of the materials to cover the cost of handling, freight, express, etc., this having been found to be approximately correct on the average. Adding the correct percentage for overhead expense is a simple matter.

The rate per hour to be charged for the job is entered in the lower left corner of the sheet, if the job is taken on an hourly basis; or the contract price is entered if a fixed sum is to be charged for the entire job. The rate per hour varies of course, with the nature of the job.

The results obtained are accurate enough for all practical purposes, and the low cost of obtaining the desired information recommends it for the small or medium sized shop.

There is another value to the cost sheets. Frequently it is necessary to estimate on similar work and records of past performance are invaluable. The shop that can estimate accurately has it all over the one that can't.

Saginaw Stamping and Tool Company
SAGINAW, S. S., MICH.

COST SHEET S. O. NO.

NAME_____ THEIR ORDER NO._____ DATE_____

DATE	CLOCK NO.	HOURS	RATE	WAGES	DATE	CLOCK NO.	HOURS	RATE	WAGES

News Section

American Gear Manufacturers' Association

Semi-Annual Meeting at Chicago Well Attended—Many Valuable Committee Reports on Standardized Gear Practice—Apprenticeship and Costs Live Subjects for Discussion

The ninth semi-annual meeting of the American Gear Manufacturers' Association took place at the Drake, Chicago, Oct. 9, 10 and 11. The meeting was characterized by the usual informality and close attention to business and much work was accomplished.

Most of the many standing committees brought in reports of progress that indicated the immense amount of hard work going on behind the scenes. Definite recommendations were presented by F. E. McMullen, of the Gleason Works as chairman of the Bevel and Spiral-Bevel Committee and were acted upon. The association approved by unanimous vote the motion of Mr. McMullen to adopt as suggested practice for future use, the Gleason system of bevel gears with three different pressure angles as published in *American Machinist*, page 849, Volume 56. The committee's recommendations as to nomenclature and thrust values for spiral bevel gears were adopted as recommended practice. This report will be published in an early issue.

A paper by Prof. D. L. Rich, of the University of Michigan on Standardization of Gear Sounds evoked considerable interest and led to a good deal of discussion. Prof. Rich stated that there were three ways of combating noise of any kind: By absorption of the noise in sound deadening material as in the soft hangings of auditoriums; by insulating the source of noise or the compartment in which it is produced; and by elimination of the noise at the source, as by improving the quality of the gears in a transmission. He discussed the various methods and instruments for measuring sounds and noises and gave as his conclusion that it would be possible to devise means of determining whether a given gear combination was noisier than a definite standard, but not how much.

Other papers were "The Evolution of the Gear," by George L. Markland, Jr., president of the Philadelphia Gear Works; "Why Buy a Pig in a Poke," by L. G. Hewins, Sales Manager The Van Dorn & Dutton Company, and "Engineering Research," by Prof. E. A. White of Michigan.

On Monday evening P. C. Molter, superintendent of the Department of Industrial Education of the National Metal Trades Association, addressed the members on Apprenticeship. The diminishing supply of skilled machinists in the industry was dwelt on by several members in the discussion that followed and the apprenticeship system was felt to be the only means of training new men to fill the gap.

At the business meeting three new member companies were elected: American Gear Company of Chicago, Dalton & Balch of Chicago, and the Manns Manufacturing Co. of San Francisco. Several additional representatives of member companies were also elected.

At the banquet the speakers were Gen. John V. Clinnin, who spoke on "The World War and Its Effect on American Business," and Judge Marcus Kavanaugh, who chose as his subject, "Business Men and Law Enforcement."

The meeting afforded the members present a good chance to get acquainted with the new secretary of the association, Mr. T. W. Owen, whose office is Room 107, 2443 Prospect Avenue, Cleveland, O. It was announced that the seventh annual convention of the association would be held in Cleveland on the last Thursday, Friday and Saturday in April, 1923.

American Engineering Standards Committee Handling 106 Projects

The growing interest in standardization on the part of almost every American industry is emphasized by the quarterly report of the activities of the American Engineering Standards Committee issued from the headquarters of the committee at 29 West 39th Street, New York City.

Of the projects which have official status before the A. E. S. C., twenty are concerned with mechanical engineering; 17 are civil engineering projects; 15 are electrical; 3 are automotive; 10 are concerned with transportation; 10 with ferrous metals; 11 with chemical; 5 with non-ferrous metals; 4 with mining; 2 with textiles; 1 with shipbuilding, and 8 projects are of general interest.

Twenty-four standards or safety codes have been approved and 36 are up for approval. The remaining 46 projects represent codes and standards which are either in the process of formulation, or which are now being considered by committees of representatives, designated by the various bodies, industrial, technical and governmental, interested in each particular subject. In this way, more than 200 such bodies are officially participating in the work of the A. E. S. C. through their accredited representatives.

A regular interchange of information as to the status of work under way is maintained by the American Engineering Standards Committee with the national standardizing bodies of Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden and Switzerland. This information is issued in the form of quarterly reports and includes a statement of the status of each project on which work is actively under way.

George Richards—An Appeal

We regret to learn that Mr. George Richards—thirty years or so ago, of the well-known Manchester firm—is new disabled owing to paralysis and quite incapable of any further work. He suffered serious financial loss during the war and, though direct appeals have been made to his relatives, is now dependent on the kindness of his friends for support. Endeavors are being made by some of these to raise a fund to assist him and, at his desire, to provide for the maintenance and education of his youngest child, a boy of 13, until he is able to support himself. Subscriptions will be gratefully received by Mr. A. J. Munro, 103 Cornwall Rd., South Tottenham, N. 15, or by Mr. Leslie N. Burt, 7 Outer Temple, W. C. 2. London, England.

This is, indeed, a worthy cause and one which merits the attention of the machine tool industry. Too often does it happen that a life spent with unexampled toil in the advancement of an industry and its products is found in the evening of its career dependent upon our generosity and gratitude. We feel sure that those of our readers who are acquainted with Mr. Richards' work in the past and know of his genius in the design of machine tools will not hesitate to help him in the adversity that has overtaken him.

Machine Tool Exports Show Little Change

Metal working machinery to the value of $1,032,483 was exported during August. This is slightly under the July exports, valued at $1,074,371. As compared with August 1921, the exports show an increase of $100,920. Exports for July, 1921, on the other hand, exceeded those of August of the current year by $702,012. The Department of Commerce furnishes the following details:

EXPORTS METAL-WORKING MACHINERY

	July, 1922	August, 1922
Lathes	$61,443	$52,963
Boring and drilling machines	28,059	31,370
Planers, sharpers and slotters	33,881	11,980
Bending and power presses	7,351	16,061
Gear cutters	25,791	15,290
Milling machines	27,597	27,631
Sawing machines	1,013	3,145
Thread cutting and screw machines	16,756	13,530
Punching and shearing machines	9,581	6,735
Power hammers	8,973	10,534
Rolling machines	129,881	734
Wire-drawing machines	2,475	1,665
Polishing and burnishing machines	330	396
Sharpening and grinding machines	54,483	79,356
Chucks, centering, lathe, drill and other	17,519	23,566
Reamers, cutters, drills and other parts for machine tools	89,485	100,295
Pneumatic portable tools	41,980	44,772
Foundry and molding machinery	28,467	70,228
Other metal-working machinery and parts of	489,306	522,232
Total metal-working machinery	$1,074,371	$1,032,483
IMPORTS		
Machine tools	$14,762	$18,926

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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TO A FRIEND who congratulated him upon his serenity in a panic, the late Pierpont Morgan is said to have remarked, "It always stops raining." His philosophic observation is recalled now because upon the expectation and declaration of stock dividends the market value of the various Standard Oil securities has increased by over a billion dollars in the past year.

Nearly one-half of this increase is due to the advance recorded since Aug. 18 last, when the market value of the various Standard Oil issues was $1,728,000,000 as compared with $2,223,000,000 on October 10. But this advance has not added a penny to the earning power or assets of the properties affected, and unless their market value was absurdly low two months ago it is now too high.

But whatever the facts in respect of intrinsic values may be, it behooves us to remember that it cannot rain stock dividends or anything else all the time and it is quite possible that the wild and thoughtless buying of oil stocks in general and Standard Oil stocks in particular which this distribution of new shares has induced may mark the culmination of the bull movement in securities.

There are other reasons for thinking that this may be the case. The Standard Oil shares are now more widely distributed than ever before. In one way or another the money market will be called upon to supply a large share of the increased capital required to carry them at their enhanced valuation. Commercial loans are meantime increasing and Secretary Mellon's action in bringing out half a billion 30 year government bonds at 4¼ per cent has established that rate as the irreducible minimum at least for the present. We may therefore expect a gradual hardening of the money market, accentuated in all probability by the freight blockade which will retard the conversion of the goods in transit into cash.

These are the considerations which lead me to advise great caution in making commitments that assume a further advance in the stock market.

From this generalization the railway shares may perhaps be excepted, for it is quite possible that the phenomenal earnings indicated by the present heavy traffic may offset the influence of higher interest rates and the speculative liquidation of the oil and industrial stocks that seems to impend.

Neither is it to be expected that the commodity markets will be susceptible to the monetary and speculative influences to which the stock market is so sensitive. There has been no great speculation in merchandise. Stocks are very light. Wages are high. There is no unemployment anywhere. In fact, a scarcity of labor is reported from some regions and there is every indication that a nation that can spend half a million dollars on a baseball game will not be deterred from making normal purchases by the slight advance in prices thus far established or in prospect.

This prognosis is confirmed by the trade reports of the week. In both the primary and retail markets a good business at gradually rising prices seems to be passing. Wheat is firmer and slightly higher. So are corn and cotton. Cotton goods are conspicuously active and firmer. There are some who are coming to feel that this year's cotton crop has been slightly underestimated, but with the president of the Manchester Exchange pleading that America should bestir itself to raise 16,000,000 bales of cotton no one now fears that a yield of even 11½ million bales this year would depress prices.

> **Those who at the present time are attributing the advance in commodity prices to inflation are implying that our gold has less purchasing power than formerly. If this be true then the inflation is a permanent rather than a temporary condition, and likely to continue as long as we insist that debts be paid in gold rather than goods for our exportable surplus.**

Wool and woolen goods, silk and its products, furs, hemp, jute, burlaps, iron, steel, copper and most other metals, coffee, sugar and rubber are all in good demand at prices which are in nearly every case of the seller's making. The advance in rubber, which is now selling at 19½ cents for January delivery, is due to the gradual crystallization of the plans for restricting the production that have been so long under consideration, and the improvement in sugar to an appreciation of the fact that the surplus stock will have nearly disappeared before the new crop becomes available.

Eggs, of which there is, curiously, an overproduction, and coal are the only articles that have declined during the week and unless the official reports are misleading there is every reason to expect that there will be enough coal to go around during the winter if no one is allowed to "hog" more than a month's consumption in advance.

For the upward tendency in prices so generally reported there must of course be some general reason. Charles J. Webb, president of the Philadelphia Textile Association, attributes it to a "second inflation" against which he warned his hearers in an address last week.

But inflation is a much used word that is difficult of definition. When it first found a place in the economists' vocabulary it meant a rise in prices due to a dilution of the currency and a consequent depreciation of its value as expressed in commodities. But unless the gold that the banks are forcing into circulation has depreciated in value or purchasing power there has been no dilution or depreciation of our currency.

Therefore those who attribute the advance in commodity prices to inflation are by implication compelled to admit that gold has less purchasing power than formerly. This is, I think, the fact, and if it is the fact then the inflation of which so many are apprehensive is a permanent rather than a temporary condition that is likely to persist in this country as long as we insist upon being paid in gold rather than goods for our exportable surplus.

That it should be exclusively reflected in the commodity markets and without effect upon securities is entirely logical, for most securities, and especially bonds, are nothing more than certificates which attest the investment of so many dollars whose number and value as expressed in the gold in which they are payable is not affected by a change in the purchasing power of the gold as expressed in commodities.

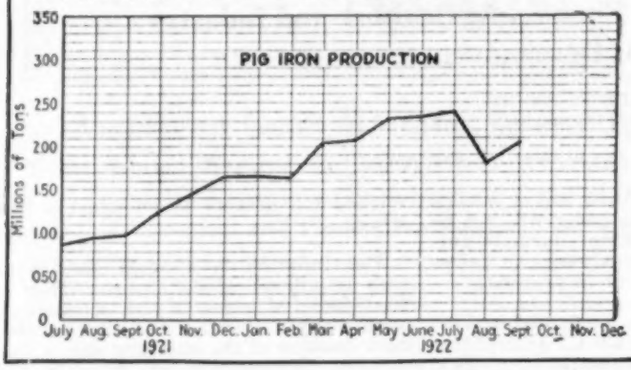
If this be correct, then it is highly probable that business will continue to feel the artificial stimulus of "gold inflation" and advancing prices until the latter is checked by an expansion of credit that will exhaust bank reserves and compel contraction. The weekly statement of the Federal Reserve banks indicates that this expansion has already commenced in that rediscounts have increased by 91 millions, but we are still some distance from the inevitable reversal for the reserve ratio of 75.7 per cent is only 1.7 below last week's figure and is quite high enough to assure comparatively easy money for some time to come.

Any serious curtailment of credit is not therefore by any means imminent, and it seems likely that the present upward movement in commodity prices will continue during the winter.

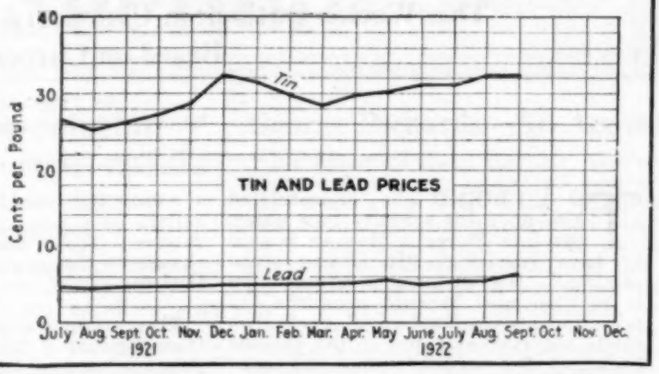
The news from abroad is reassuring and the barometer of sterling exchange, which is higher, indicates clearing weather in Europe politically as well as financially.

The German mark, which sold as low as 3¼ cents a hundred last Tuesday, is so low that it is hardly worth talking about. My private advices are that dollars are generally displacing it as a medium of exchange in Germany and the time is probably approaching when the mark will be officially, as it is now practically, demonetized.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG iron production during September totaled 2,033,720 tons as against 1,816,170 tons in August, an increase of 217,550 tons which was not unexpected in view of the settlement of the labor troubles in the coal and railway fields. While September production is about 370,000 tons below the high point reached in July, it compares favorably with the average monthly production for the 9 months of the current year amounting to 2,033,993. An increase in the number of furnaces placed in operation toward the end of September is expected to result in a large October output.

Tin and lead prices were strong during September, the average price of the former showing but a fractional decline from 32.134 cents in August to 32.075 in September. Lead moved up to 6.110 cents as against 5.824 cents in the previous month. While there has been but a narrow demand, the low status of stocks on hand has served to keep the price firm. Present indications point to higher prices in the near future.

Automobile share markets were strong during September, the average price for ten representative issues advancing to $45.65 per share as compared with $43.40 in the month previous. Except in a few cases, where new financing is under way, the car manufacturing companies show healthy financial statements. Production of cars and trucks continues to record high totals and the demand both for domestic and export consumption shows a steady increase.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

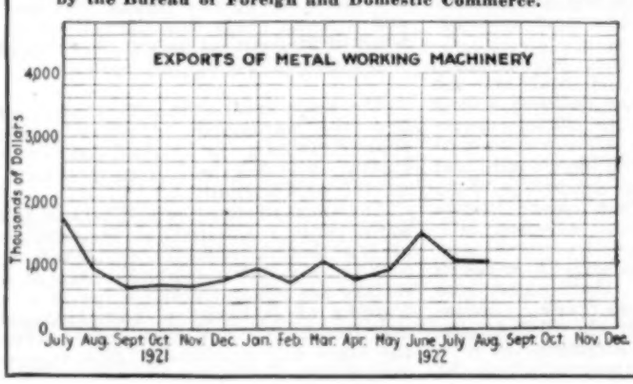
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0292	$0.0285	$0.0273
Cold finished shafting	per lb.	0.0378	0.0365	0.0384
Brass rods	per lb.	0.165	0.1700	0.135
Solder (½ and ½)	per lb.	0.22	0.225	0.20
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	.....
Lard cutting oil	per gal.	0.575	0.575	.....
Machine oil	per gal.	0.36	0.36	.....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Metal working machinery exports held up well in August and were valued at $1,032,483. This total is exceeded in the current year only by the exports for March, valued at $1,057,106 and July, valued at $1,074,371. As compared with the month of August, 1921, however, there is an increase shown of $100,920. Imports of machine tools continue in small volume. Tools to the value of $18,926 were brought in during August as against $14,762 in July and $16,101 in the same month a year ago. With an improvement in the European situation, and with an adjustment of war debts upon a reasonable basis, an era of industrial activity should follow, resulting in a wide expansion of machine tool exports.

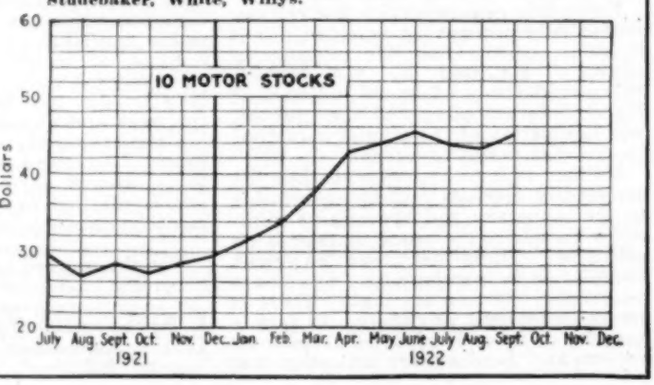
Steel ingot production in September according to figures compiled by the American Iron and Steel Institute, totaled 2,373,779 tons, an increase of 159,197 tons over August. This compares with the current year's high point reached in May with a production of 2,711,141 tons.

Railway earnings on American roads experienced a sharp decline in revenue during August due to the shopmen's strike as compared with July and with August, 1921. The total net operating income for 197 roads of Class 1, for August amounted to $52,579,799, or at the rate of 2.65 per cent as against July income of $69,239,037, or 4.04 per cent, on the assumed valuation of $19,165,800,000 for American railway properties, in excess of $95 millions monthly required for 6 per cent return.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



British Textile Machinery Industry

Extraordinary Prosperity Since the War—Former Markets Being Recovered—Big Increase Shown in Exports

By A LONDON CORRESPONDENT

WHILE every other industry in Britain has been in the depths of depression during the last two years, it is a curious fact that the textile machinery trade has enjoyed a unique experience. At a time when every other English trade was suffering acute unemployment, due to the blighting influence of the very general slump, there has been no lack of work for the textile machinist in Lancashire. Orders have poured in from all parts of the world. The devastated factory towns of France and Belgium have been excellent customers, while from the Far East and many parts of the Empire heavy demands have come for the textile machinery specially made in the north of England.

The leading firms have indeed had the time of their lives, although no one can honestly begrudge their good fortune. The profits of one well-known Lancashire firm were enough, in 1921, to pay a dividend on the ordinary shares after providing for all liabilities, fixed charges, etc., and allowing a large sum to be carried forward of not less than 37 per cent, although the management wisely decided to put part of this to additional reserve against future lean years.

Exports Approach Pre-War Point

This is just a sample of what has been going on in the English textile machinery trade during the last 18 months or so. And there is every indication of this activity continuing as large orders are coming to hand from the Far East, especially India, which is one of the very best customers for our textile machinery.

To give an idea of the magnitude of the business done, I may add that in 1913 the value of shipments of textile machinery was just over £8,000,000, whereas in 1921 it was over £25,000,000. The tonnage last year, however, was 156,995 as against 176,074 in 1913, figures which are eloquent as to prices. Ten years ago the price paid per ton for this class of machinery was £47. In 1921 the average price was £160. This year the rates have been easier, the prices paid by foreign customers having gradually fallen to £148 per ton, but high rates will rule for many a long day as the demand shows no considerable diminution.

When the war ended it was found that France and Belgium were largely destitute of textile machinery, this being the case particularly in northern France, the object of the Germans having been to destroy the French textile industry which they thought they could do by smashing up all the productive machines. If they could have destroyed all the Lancashire textile machinery workshops and all the patterns contained therein, they would have been much nearer their object. Today the French textile factories which were destroyed have been largely rebuilt with new British machinery.

When the war came to a close an agreement was entered into between the British, French, and Belgium Governments that the two latter nations should have a prior claim upon deliveries from British textile machinery factories. This understanding has been carried out with the above-mentioned result. It may be added that a leading British association has put into operation in France a new mill of over 50,000 spindles.

While British textile machinists have been very busy repairing the ravages of war on the Continent, that alone would not have been sufficient to have created the boom had not large orders been received from the great Far Eastern markets, such as India, China, Japan, etc. It is officially stated that two English firms alone have booked orders aggregating £13,000,000.

> With the engineering industries of England in the past two years suffering, perhaps, the most severe depression ever experienced in their history, the activity of the producers of textile machinery in the British Isles stands out in bold relief. From all quarters of the globe have come orders for machinery to produce fabric for the world's inadequately clothed population. A careful survey seems to indicate that it is only a beginning.

Shipments of textile machinery to India of late years have been on a very extensive scale. In 1913 English exports were 50,000 tons, valued at £2,000,000, against over 60,000 tons in 1921, valued at nearly £9,000,000. It is currently reported on very good authority that British makers have extensive contracts on their books for Indian firms, and it is thought likely that shipments will continue on a large scale for the next three years at least and perhaps longer. The mills in India have increased in number, from 56 in 1880 to 253 today. In the same period there has been an increase in the number of spindles from 1,462,000 to 6,763,000, looms also increasing from 13,500 to 120,000.

Great Activity in the Orient

There is every indication that China also has entered upon a period of activity in cotton manufacturing and this is one of the most promising markets for textile machinery. In 1913 England sent only 3,382 tons of such machinery to China, valued at £138,058. Last year the shipments totalled 16,489 tons, and were valued at over £2,000,000. Today China has 63 cotton mills containing 1,650,000 spindles and 7,650 looms, with many others planned or contemplated. It is a source of satisfaction to see that a more enterprising and enlightened policy is now being adopted by commercial organizations in the extension of cotton spinning in the Orient.

Japan is another market where British textile machinery has done well lately and which offers splendid opportunities for the future. In 1913 English exports to that country of such machinery totaled 19,688 tons, valued at £802,643. In 1921 they totaled 22,531 tons, valued at over £3,000,000 and this in spite of the depressed condition of Japanese trade. Of course, during the period of the war Japanese manufacturers had the time of their lives and made huge fortunes, but matters are very different today. In consequence of the small amount of shipping which was available to send supplies of goods from England to India, Japanese merchants naturally took advantage of their opportunities and secured a substantial amount of business from India. Japan now possesses 119 mills containing 3,814,000 spindles and 50,600 looms. The latest reports from Japan indicate great activity in building new textile mills all requiring equipment.

Japanese Capital in China

But Japanese capitalists are not alone content with their home market. At the present time they are largely interested in erecting cotton mills in China and it has recently been reported that British firms have received new orders for spinning machinery to be supplied to China under the auspices of Japanese capitalists. One order, it is stated, is for over one million spindles. According to the latest official figures by the British Board of Trade,

TABLE No. 1, SHOWING TONNAGE AND VALUE OF BRITISH TEXTILE MACHINERY FROM THE UNITED KINGDOM FROM 1913 UP TO AND INCLUDING THE FIRST SEVEN MONTHS OF 1922

Year	Tons	£
1913	178,074	8,281,848
1914	116,383	5,766,502
1915	59,447	3,332,365
1916	59,268	4,107,707
1917	49,271	4,203,671
1918	36,531	3,943,001
1919	65,938	8,430,725
1920	63,314	9,158,773
1921	157,005	25,148,832
1922 (7 months)	77,275	11,488,339

Japan and China have really been the backbone of the recent boom of English exports of textile machinery to those countries.

Lancashire textile manufacturers are, of course, quite aware of this enormous export of machinery which is for use in foreign factories and destined to produce textile goods in competition with their own. On the face of it, it looks as if Lancashire would gradually lose its export cotton trade and that it is in a sense "cutting its own throat" by sending large quantities of textile machinery to India, China and Japan, thus enabling manufacturers in those countries to produce large quantities of cloth. It is generally thought, however, that it will be a long time before the new mills can have very serious effect

TABLE NO. 2, SHOWING THE BRITISH EXPORTS OF TEXTILE MACHINERY, THE COUNTRY TO WHICH SHIPPED, AND THE TONNAGE AND VALUE IN EACH CASE

Exported to:	1913 Tons	1913 £	1920 Tons	1920 £	1921 Tons	1921 £
Russia	15,308	995,296	188	40,973	3	2,235
Germany	13,917	783,896	43	15,771	341	121,399
Netherlands	12,171	412,515	1,374	182,493	2,470	374,581
France	12,630	735,901	17,001	2,836,054	24,383	4,332,017
Other European countries	22,695	1,162,142	8,948	1,404,067	12,720	2,788,299
China	3,382	138,058	2,616	306,022	16,499	2,097,799
Japan	19,688	802,643	8,051	860,221	22,531	3,086,298
U.S.A.	3,939	250,784	1,745	337,641	6,397	1,476,998
South America	12,879	531,432	2,239	363,546	5,404	868,092
British E. India	50,437	2,001,157	17,945	2,303,275	60,276	8,873,424
Australasia	1,417	64,008	632	109,698	1,691	284,531
Other countries	9,611	404,016	2,532	399,072	4,290	843,159
Totals	178,074	8,281,848	63,314	9,158,733	157,005	25,148,832

upon the export of textiles from Britain. It should also be remembered that the machinery recently installed is really four times dearer than pre-war values. This increased cost of machinery will be a serious handicap to those mills when they come to compete with mills not so burdened with expensive plant. It should also be remembered that the standard of living throughout the world steadily improves and as the huge populations of India, China and Japan become more civilized and rise nearer to Western ideals of life, they will tend to clothe themselves in fabrics that are of better quality than they have done heretofore.

In table No. 1 there is shown the development of this branch of British engineering industry, the tonnage and value of British textile machinery exports being given for the years 1913 to 1922.

In table No. 2 a segregation is shown of the principal markets to which British textile machinery has been exported in the years 1913, 1920, 1921.

It is interesting to note that the value of exports of textile machinery from the United States has risen from $1,611,279 in the year ended June, 1914, to $10,507,822 in 1921. The exports to China during this time have risen from $51,478 to $2,783,093 in 1920. To Japan they have increased from $10,608 to $3,764,247. These two countries have also taken the bulk of American exported textile machinery. British East India is another country well worth attention. In 1914 her importers of this class of machinery only purchased $252 worth of machinery of American manufacture which in 1918 bounded up to over $300,000 but fell in 1920 to $44,707. In 1919, the United States were sending England over 3 millions' worth of this machinery, but in 1920, the last year for which figures are available, the trade had fallen to $96,746.

The Far East is undoubtedly the great market for the future for both British and American textile machinery.

An encouraging demand for many years seems to be assured and there is not likely to be over-production or extreme competition so far as Britain is concerned. British makers will be very busy filling orders for the home mills, for replacement of old and worn-out machinery and for extensions so that their attention will not necessarily be given entirely to the foreign markets.

The textile machinery builders of this country have, indeed, been fortunate. They have been working at high pressure for the last two years, while the other branches of the industry have been in the depths of the depression, many principal firms only receiving last year 10 per cent of the orders they executed in 1920 and 1919.

The S. A. E. Production Meeting

The Production Meeting of the Society of Automotive Engineers to be held in Detroit, Oct. 26 and 27 is to be a marked departure, which it is hoped and believed will be helpful in many ways. Originated by the engineers of the industry, the society has never before seen its way clear to give the production departmnets the benefit of close co-operation and closer social unity and this meeting is the first step to bring about this very desirable condition.

The personnel of the committees insures an interesting meeting. Members are: Meeting and Papers Committee, Karl L. Herrmann, Chairman, Thomas J. Litle, Jr., F. A. Whitten and C. Harold Wills; Factory Visits Committee, Kirke K. Hoagg, Chairman, E. F. Roberts, Thomas J. Litle, Jr., Howard A. Coffin and George E. Goddard.

There is every reason to believe that this will become an annual affair and one which cannot fail to be of lasting benefit to the industry. One notable feature is that every paper will be written by men who are in the production departments of the various plants, and who know from actual experience what is being accomplished. A glance at the list of papers and their authors will show the kind of information to be expected.

The meeting should attract production men and machine tool builders from all parts of the country and non-members will be made welcome in the good old S. A. E. way. There will be two morning sessions and at least four factories will be visited in the afternoons. An informal dinner, which is always an interesting feature of these conventions, makes another method of getting acquainted with the men in the industry. Every production man who can arrange to attend should do so. The papers are to be as follows:

Thursday, Oct. 26, 9:30 a.m.: The Group-Bonus and Its Application, by E. Karl Wennerlund; Cylinders From the Ore to Finished Part, by P. E. Haglund and I. B. Scofield; Tool Allotment and Costs, by F. A. Mance; New Methods of Processing Splined Shafts, by J. A. Ford.

Friday, Oct. 27, 9:30 a.m.: Problems Met in the Production of Air-Cooled Engines, by William Dunk; Some Experience from a Production Note-Book, by H. J. Crain and J. Brodie; Production Errors in Gears, by K. L. Herrmann; Selection of Machine Tools, by A. J. Baker; Machine-Tool Efficiency, by R. K. Mitchell.

There are many unusual problems met in the building of air-cooled engines and William Dunk of the Franklin organization will describe them in his paper. A. J. Baker of the Willys-Overland Co. will offer some pertinent suggestions on the selection and purchase of machine-tools. His paper will interest tool supervisors and factory superintendents.

Exporters Convention Opens Oct. 25

"Better Times Through Foreign Trade" is the slogan for the thirteenth annual convention of the American Manufacturers Export Association which will be held in New York City, at the Waldorf-Astoria hotel, Oct. 25 and 26. Responses so far received from invitations sent out to members point to a record attendance.

The opening session will be held on Wednesday morning, Oct. 25, at which delegates will be registered, reports of officers and committees will be received and new officers elected.

President Myron W. Robinson will address the afternoon session at which Dr. Julius Klein of the Department of Commerce will preside.

The speakers for the afternoon session of Oct. 25 have been selected from the various divisions of the Department of Commerce and the topics to be discussed are: Trade Situation in Western Europe, by Alan G. Goldsmith, chief of the Western European Division; Trade Situation in Eastern Europe, by Dr. E. Dana Durant, chief of the Eastern European Division; Trade Situation in the Far East, by Frank R. Eldridge, Jr., chief of the Far Eastern Division; Trade Situation in Latin America, by Ralph H. Ackerman, chief of Latin-American Division; Foreign Trade Disputes and Arbitration, by Archibald J. Wolfe, chief of Commercial Laws Division.

At the morning session of Thursday, Oct. 26, the topic will be "Shipping" which will be discussed by: Hon. Edward C. Plummer, commissioner, United States Shipping Board; and W. Averill Harriman, chairman of the board, United American Lines. Homer L. Ferguson, president and general manager, Newport News Shipbuilding and Dry Dock Co. will act as chairman.

In the afternoon the new tariff law will be discussed by: W. S. Culbertson, vice-chairman, Tariff Commission, Washington, D. C., and U. S. Senator Joseph S. Frelinghuysen, of New Jersey. W. W. Nichols of the Allis-Chalmers Manufacturing Co., Inc. will preside.

The annual banquet will be held in the evening of Oct. 27 with Alba B. Johnson of Baldwin Locomotive Works acting as toastmaster.

British Pig Iron Output Gains in August

According to a report recently issued by the National Federation of Iron and Steel Manufacturers of Great Britain the British production of pig iron in August amounted to 411,700 tons, or 12,600 tons more than in July. The average monthly output in 1913 was 855,000 tons. The August output included 120,200 tons of hematite, 137,400 tons of basic, 102,200 tons of foundry, and 22,900 tons of forge.

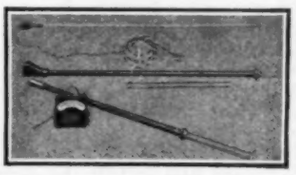
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pyrometer for Molten Metals, Portable

Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.

"American Machinist," August 24, 1922



The pyrometer outfit gives instantaneous temperature measurements of molten metals and has renewable thermo-couple ends. It consists essentially of a standard Type-PA portable meter connected by 20 ft. of flexible copper cord to the thermo-couple. The two bare wires on the end of the couple are ordinarily furnished in 16-in. lengths. They are inserted into the molten metal, such as brass, bronze, aluminum, copper or babbitt, and the temperature can be read almost instantly on the meter. The upper temperature limit is about 2,200 deg. F. The scale of the meter is graduated directly in degrees F. from 32 to 2,500. Size, 6¼ x 6 x 3 in. Weight, 5 pounds.

Metal, Non-Ferrous Alloy, "De Bats," No. 4

De Bats Sales, Inc., 60 South St., Boston, Mass.

"American Machinist," August 24, 1922

The metal is in the tungsten-chromium-cobalt class and possesses endurance and ability to withstand high speeds when cutting cast iron and the higher alloy steels. It contains no ferrous compounds and is non-magnetic. It is melted in electric furnaces and cast in molds of steel in the form of toolbits, inserts for built-up milling cutters, twist drills and reamers. The metal cannot be forged nor annealed, and can be worked only by the grinding process. It may be given rake and clearance angles approaching those of high-speed steels. Standard sizes of toolbits are furnished to be held in holders, while for more severe duty slabs or blocks are welded to carbon-steel backings.

Scriber, Self-Guiding, "Duwell"

J. A. Finley Co., 20 Braintree St., Allston, Mass.

"American Machinist," August 24, 1922

The self-guiding scriber is intended for the use of mechanics, particularly tool makers. It has a double point by means of which an outline at the bottom of a small, irregular-shaped hole may be laid out. One of the points is made sharp to do the scribing while the other one is slightly rounded and a trifle shorter. The points are pressed together and put in the hole. The tool is twirled around and the spring point causes the scribing point to follow the outline of the hole. For larger holes the single point at the opposite end of the tool is used in the regular manner.

Centering Device, "Duwell"

J. A. Finley Co., 20 Braintree St., Allston, Mass.

"American Machinist," August 24, 1922

The tool is for center-marking round stock rapidly and accurately. The hub has a reamed hole through its axis to which is fitted a ground center punch. Extending radially from the hub are three steel posts, equi-distantly spaced around the periphery, and upon each post is a sliding jaw. A bushing or spider, having an equal number of radial bosses fits over the hub so that it may be rotated without endwise movement. Connecting rods join the radial bosses to the jaws upon the hub, so that when the bushing is rotated relative to the hub the toggle action of the rods causes the jaws to slide simultaneously inward or outward according to the direction of the rotation. After centering, a light blow of the hammer on the outer end of the punch marks the center.

Wrench, "Kant-slip"

Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

"American Machinist," August 24, 1922

The wrench will grip work of any shape and readily adjust itself as to size. The sliding fulcrum is closed to the load and there are no screws, pins or springs to wear out or break. On top of the stationary jaw is a raised flat, forming a hammer head so that the wrench can be used as a hammer for light blows. The opposite end of the stationary member is formed into a screw-driver.

Washing Machine, Metal-Parts

Crescent Washing Machine Co., New Rochelle, N. Y.

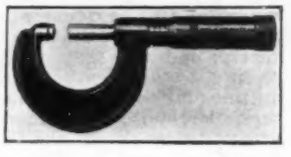
"American Machinist," August 24, 1922

The machine is for washing metal parts that are handled in quantities of 50,000 to 100,000 or more per day, and is arranged for washing, rinsing and drying. It is fitted especially to clean work requiring a great force and volume of water. A 3-hp. motor drives the pump for the rinse water. Small objects are placed in racks made of wire mesh, and two racks 18 x 24 in. in size can be fed into the machine side by side. They are carried continuously through the machine on the conveyor, so that they pass under both the washing and rinsing sprays. Capacity, 24 in. high, 40 in. wide and 16 ft. long.

Micrometer, 1-Inch, No. 435

L. S. Starrett Co., Athol, Mass.

"American Machinist," August 24, 1922

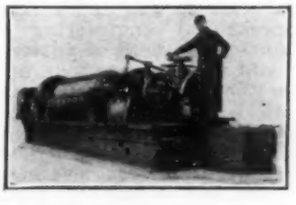


The frame is drop-forged with a ribbed section that adds greatly to its rigidity. It is finished in black enamel. The diameter of the screw is 0.312 in. and that of the contact points 0.270 in. Decimal equivalents are marked on the thimble. The micrometer can be furnished either with or without a ratchet stop.

Grinding Machine, Roll, Heavy-Duty

Landis Tool Co., Waynesboro, Pa.

"American Machinist," August 31, 1922



The grinding machine is for finishing all types of hot and cold mill rolls. It is entirely self-contained and is driven by three separate motors, one driving the work, another driving the grinding wheel, and a small motor driving the water pump. All three are controlled by means of push buttons on the operator's platform, which is mounted on the grinding wheel carriage so that the operator has a clear view of the wheel and the work. The wheel can be moved rapidly toward and away from the work. An attachment is fitted for grinding the periphery of the roll either concave, convex or straight.

Clip, paste on 3 x 5-in. cards and file as desired

Death of Chas. S. Gingrich

In the death of Charles Sumner Gingrich the machine tool interests of the country have lost one of their most active and widely known members, Mr. Gingrich passed away on October 10, 1922, aged 48 years. For twenty-two years he had been in the sales engineering department of the Cincinnati Milling Machine Co., and during his latter career was in charge of this important division of the company's work.

Those who knew Mr. Gingrich appreciated his rather unusual and remarkable personality, for he was not only an acknowledged expert in his particular line, but he possessed a mind of distinctly scientific bent. His interest in his daily work did not exced his study of abstract scientific subjects of a diversified character. The general laws of nature as they are expressed in physics, astronomy, botany and chemistry, captured his vidid imagination and occupied the time he could spare from his business career. There was probably no field of material science in which he had not a very intelligent, well organized knowledge. Naturally his mind turned from abstract principles to direct application with ease and surety, and his study of the relation of science to business stimulated in him an unusual concern in educational matters. He had a deep interest in the engineering work of the University of Cincinnati, and in the young men of that institution. His interest was evidenced by an active co-operation with the students employed by his company and in fact with all embryo engineers with whom he came in contact.

Mr. Gingrich was a man who thought clearly, and who acted directly. He translated his theories and his human interests into deeds of practical worth, whether it was in his relations to his mechanical engineering field or to students in need of advice and counsel.

On his business side he was known best as one of the group of able men who, during the last twenty years, have brought the Cincinnati Milling Machine Co. to its present position in the field of mechanical engineering.

He had a host of good and loyal friends throughout the country and his loss will be felt keenly in his business circles as well as in the scientific groups which were his chief pleasure next to his home.

(The above commentary on the life of Mr. Gingrich was written by Herman Schneider, Dean of the College of Engineering, University of Cincinnati, his closest friend.)

A.B.P. Convention Emphasizes Need for Accurate Facts and Figures

The seventeenth annual convention of the Associated Business Papers, Inc., was held at Hotel Astor, New York, October 11, 12 and 13. Simultaneously with it, the editorial conference had a very interesting session. Chief among the papers was one by Henry B. Dennison, president of the Dennison Mfg. Co., who pointed out the necessity of facts and figures in modern business. He maintains a research department to secure and record facts such as costs of materials, details of sales, personnel and other phases of the business.

Older types of managers sometimes resent the use of charts and figures, contending that it tries to replace business judgment. Nothing could be more erroneous as judgment can be no better than the facts on which it is based —and many times much worse. The use of facts tends to prevent quick decisions or snap judgments which are frequently wrong. He recognizes the value of intuition, but even here, real facts and figures help out in many ways.

Facts as a Buying Guide

The growth of the demand for facts has been very noticeable in his own organization in which committees are used very extensively. When the executive group has the facts, better judgment can be expected. A particularly good example was the fluctuations in the price of turpentine. Taking the average price for a period of years the policy is to buy relatively little when the price is above the average and more when it is below. This is believed to be better than to attempt to always buy at the very lowest price.

Records of individual employees, their performance as a whole, not only quantity or quality, but faithfulness, resourcefulness, initiative and dependability are all important factors which can only be accurately and fairly known by suitable records. And now they are applying records and time study to sales. They find that waiting time varies from 13 to 21 per cent, that 15 per cent is spent in clerical work on reports, etc.

Perhaps the most interesting and vital chart from the viewpoint of the machine builder is the chart of facilities so as to know when to order new machine equipment. This must be based on the line of normal growth and cannot depend on immediate needs except in the case of equipment which can be bought out of stock in the open market. When special machines which will take from 6 to 18 months for delivery are needed, they must be ordered in sufficient time. Facts and figures are not an end in themselves, but merely an aid to sound business judgment. And the aim of all business should be service to mankind.

Theodore H. Price, the well known economist spoke on the problem of selling to foreign countries in spite of tariff and other handicaps. Theoretically this seems impossible, yet he believes that men will find a way to buy the things they really want. And as we raise and manufacture many things which the rest of the world desires, he feels that they will find some way to buy them. We must, however, take long time paper or promises of pay, perhaps in the form of securities.

Mr. Price does not share the pessimism regarding the countries of central Europe, but likens the conditions to those in the South after the Civil War. Then Europe loaned money on Southern property, the Scotch being particularly noticeable in loaning on Southern cotton plantations. England also helped materially in financing our early railroads, London being the trading center for U. S. railroad bonds. He believes that well selected European securities will come back into good paying properties and points to Czecho-Slovakia as an example of what can be done.

Mr. Price decries the stress which is being laid on business cycles, believing it bad psychology to implant the idea that a business depression must follow a period of good business. He believes that the peaks and hollows of these cycles can be largely wiped out by a proper study of business conditions. He has faith in the collective judgment of the people of a democracy as usually being wise and prevailing.

The third session received a message from the American Engineering Standards Committee. A recommendation that was made that we clarify our speech. The business sessions took up the problem of selling advertising.

Business Items

The Spotz Manufacturing Co., Inc., Stamford, Conn., has been incorporated under the laws of Connecticut to manufacture machinery, and mechanical devices, etc. The concern will have a capital stock of $100,000, and will commence business with $50,000. The incorporators include: C. A. Spotz, Greenwich, Conn.; Carleton Pratt, 58 West 72nd St., New York; H. M. Rice, 100 Broadway, New York; William H. Spect, 337 East 87th St., New York; F. F. Harrower, Norwalk, Conn.; G. H. Bergmark, 200 Washington Ave., Pleasantville, N. Y.; O. A. Helmer, 645 Lexington Ave., New York., and A. H. Emery, Jr., Glenbrook, Stamford, Conn.

The Ford Motor Co. American plants for August established a new high production record of 136,132 cars and trucks. This compares with 130,107 for the month previous and with 109,172 for August, 1921.

The Rock Island Railroad, it is reported, will place orders for 40 new locomotives in the near future. Of the total order, 30 locomotives will be of the Mikado type and the remaining 10 of the Mountain type.

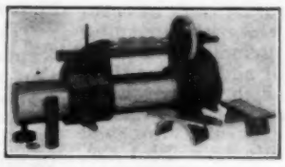
The Corner-Lock Manufacturing Co., Natick, Mass., has been incorporated under the laws of Massachusetts, to engage in the manufacture of locks, devices, etc. The capital stock is $50,000, and the incorporators include: Frank W. Everett, president; William F. Poole, 269 Chapman St., Canton, Mass., treasurer, and Dwight W. Robinson, secretary.

The Osgood Bradley Car Co., Worcester, Mass., has recently received an order for 100 electric cars for the United Electric Railways Co., Providence, R. I. The cars will cost about $12,000 each. The company has enough business on hand to keep them busy

Condensed-Clipping Index of Equipment

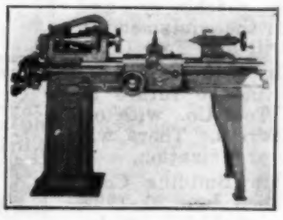
Patented Aug. 20, 1918

Micrometer, Bench Measuring Machine, "Super"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," August 31, 1922



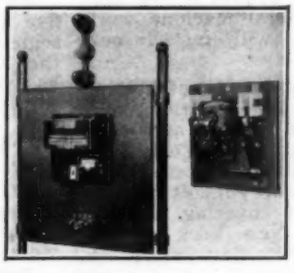
The "super-micrometer" has a capacity up to 8 in. in diameter, although its direct measuring capacity is only 0.500 in. The wheel is moved by a belt engaged by the knurled knob which has a smaller knob attached to it for rapid spindle adjustment. The final adjustment is made by turning the large knob very slowly. The rotation of the knob is continued until the belt slips. The standard inch blocks used in setting up are accurate within five millionths of an inch. The marks on the spindle are 0.050 in. apart. The 500 divisions on the dividing wheel are $\frac{1}{10}$ in. apart and each one denotes 0.0001 in. The channeled bar may be reversed for supporting flat work and the two tables can be laid on the bed to support larger work.

Lathe, "Junior," 12-Inch
Hendey Machine Co., Torrington, Conn.
"American Machinist," August 31, 1922



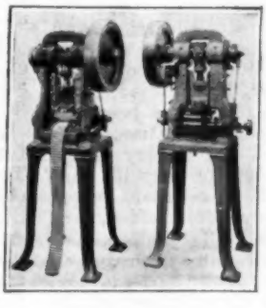
The tool is for light manufacturing purposes, in small shops and for vocational school service, where the full complement of attachments is not needed. It is belt-driven through a four-step cone, and is provided with change gears for screw cutting. Feed may be obtained either through the change gears or through a feed belt running over a three-step cone. Threads from 2 to 36 per in. may be cut. As in the regular model, the carriage traverse is stopped, started or reversed by the movement of a lever on the apron. With the two-speed countershaft furnished, 16 spindle speeds are available. The carriage is fitted with power crossfeed and compound rests.

Temperature Regulator, Automatic
Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.
"American Machinist," August 31, 1922



The apparatus is for controlling the temperature of electric, oil or gas furnaces automatically, and operates every 30 sec. to test the temperature. The regulator is best adapted to the electric furnace. When the furnace is operating within 8 deg. F. of the desired temperature, a white signal light appears. If the temperature goes below this limit, a green light appears, while if it goes above a red one is lighted. The mechanism operates the control switch, so that the error is corrected before it has deviated more than 10 deg. from the desired temperature. The small motor operating the regulator can be supplied for either a.c. or d.c. of 110 to 220 volts.

Press, Punch, Pillar
Geo. W. Dover, Inc., Providence, R. I.
"American Machinist," August 31, 1922

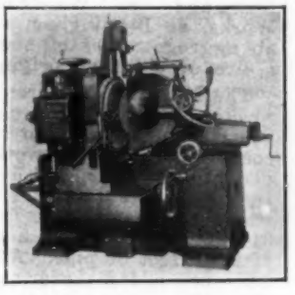


The press was developed primarily for work on radiator cells, although it is adapted to any sort of sheet-metal work within its capacity. It may be equipped with a roll feed. The machine is driven by a 3-in. belt on an 18-in. diameter flywheel having a solid web. Ram: stroke, 1¼ in.; vertical adjustment, 2 in.; maximum distance to bed, 5 in. Bed, 9½ x 11 in. Floor space, 36 x 40 in. Weight with legs, 700 pounds.

Press, Toggle and Lever, Pneumatic
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
"American Machinist," August 31, 1922

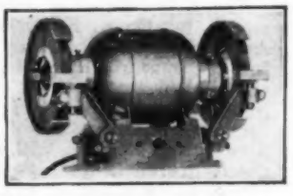
The general utility press is operated by means of compressed air or steam, with a power mechanism similar to that used on the riveters formerly made by the concern. It can be arranged with various forms of platens or work-supporting structures, so as to make it adaptable to straightening, bending, forcing, marking, embossing, coining, forging, briquetting and multiple riveting. The machine is made in tonnages of 15, 20, 30, 50, 70, 80, 100, 125, 150 and 200. It can be moved without moving any auxiliary equipment and requires only a small floor space. The die is mounted on an adjusting screw, controlled by hand or foot. The length of stroke can be adjusted.

Grinding Machine, Centerless
Reeves Pulley Co., Columbus, Ind.
"American Machinist," August 31, 1922



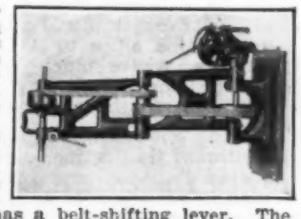
The special feature of the new model is the "drop-in" work rest which makes it possible to grind either shouldered, tapered or straight work. The rest supports the work in a true horizontal position between the two wheels, and a stop is provided which may be adjusted for different lengths of rolls. Another feature is the balancing ways and arbor for grinding wheels. Holes are drilled in the chuck just within the bore of the wheel and the balancing pins are furnished to be placed in the holes opposite the heavy spot.

Grinder, Electric, 8-Inch
Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md.
'American Machinist," August 31, 1922



The small bench grinder carries wheels 8-in. in diameter and ¾ in. wide, and is driven by a ½-hp. motor. The motor is not of the universal type, but is intended for operation on either d.c. or a.c. of 40 or 50 cycles and can be furnished for voltages of either 110 or 220. Large bearings carry the combined motor shaft and spindle. The no-load speed is 3,600 r.p.m. Two abrasive wheels, two wheel guards, two adjustable tool rests, a toggle switch in the base and 5 ft. of electric cable fitted with an attachment plug are furnished. The machine is arranged for mounting on a bench, but may be equipped with a pedestal. Weight, 75 pounds.

Drill, Wall Bracket
Hammond Manufacturing Co., 6545 Carnegie Ave., Cleveland, Ohio
"American Machinist," August 31, 1922



The light swinging drill is for attachment to a wall or post and reaches any point within a radius of 3½ ft. of its fastenings. It is adapted to work on parts for electrical instruments, switchboards, and stoves. The drill is belt-driven through tight and loose pulleys. The countershaft is geared to the upright shaft, from which two belts carry the drive to the spindle. The countershaft yoke can be set to any position to conform to the overhead drive, and has a belt-shifting lever. The two arms swing on stationary sleeves. The spindle has a No. 2 Morse taper hole and a traverse of 2½ in. Two spindle speeds of 500 and 1,300 r.p.m. are provided. Capacity, ½ in. in steel. Weight, 250 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

until next summer, and it is also expected to add to the present working force of 1,300 men.

The Connecticut Metal Treating Co., 207 Knowlton Street, Bridgeport, Conn., whose factory was completely destroyed by fire recently, has temporarily taken over the hardening plant of the Bridgeport Engineering Corporation, on Seymour Street, Stratford, Conn., and will continue operations there, until their new factory, now being planned, is completed.

The Delta File Works, Philadelphia, has reduced its list of files in accordance with the suggestion of Secretary Hoover of the Department of Commerce. The new list is supposed to include all the files needed by 95 per cent of file users, and the company points out to dealers that the other 5 per cent of business costs more than it is worth. This is in line with the tendency of manufacturers in some other lines and is a step in the right direction.

The Atlas Machinery and Supply Co., the Interstate Belting and Packing Co., and the Walstrum Armature Works, at Birmingham, Ala., suffered an aggregate loss of about $30,000 in a fire of unknown origin.

The McWane Cast Iron Pipe Co., according to an announcement recently by J. R. McWane, president of the company, has started work on the large plant to be constructed at Birmingham. It will require several months to construct the factory, the first unit being 340 by 108 feet, with a daily capacity of 8,000 feet of pipe. Additional units will be added covering, ultimately, about 30 acres.

The Mobile Pulley and Machine Works announces that an additional unit to its plant for the manufacture of steel and miscellaneous steel castings will be established at Mobile in the near future.

The Kilby Pipe Co., incorporated this month by E. M. Kilby and others, of Anniston, announces that another plant for the manufacture of pipe is to be established this year at Anniston, Ala. Foundry and shops will be established for the manufacture of castings and pipe fittings. This will give Anniston about fifteen large pipe plants.

The St. Petersburg Welding and Machine Co. has been organized and incorporated at St. Petersburg, Fla., with a capital of $20,000, and plans the establishment of a welding plant and machine shop. Officers are: T. D. Orr, St. Petersburg, president; D. J. Galaher, vice-president; A. M. Galaher, treasurer, and M. D. Shilling, secretary.

The Northwestern Expanded Metal Co., of Chicago, with a southern office at 716 Forsyth Building, Atlanta, has moved this office to 33 Poplar Street, Atlanta, where much larger quarters are provided, according to Arthur J. Swanson, southern manager.

The Southern Machinery Co., of Quitman, Ga., is increasing the capacity of its shop and foundry approximately fifty per cent by the construction of an additional unit, according to F. C. Underwood, president. The addition will be about as large as the present plant.

The Elliot Co., of Jeannette and Pittsburgh, Pa., manufacturer of power accessories, recently mentioned as planning the establishment of a southern sales office and warehouse in Atlanta, has opened offices in the Haas-Howell building in charge of H. A. Hoffman. The Atlanta office is the twelfth branch established by the Elliot Co.

The Rivett Lathe and Grinder Co., Boston, Mass., manufacturer of precision bench lathes, internal grinding machines and radial grinding machines announces a change of address for their Detroit sales office, which is operated in conjunction with that of Reed-Prentice Co., Becker Milling Machine Co., and Whitcomb Blaisdell Machine Tool Co., under the management of T. C. McDonald. The new quarters are located at 6526 Cass Ave., opposite General Motors Building. The sales force has been augmented by the addition of E. B. Barber, formerly superintendent of the factories of Lafayette Motor Co.

The Ampco Twist Drill and Tool Co., 18th and Howard Streets, Detroit, Michigan, has taken over the entire assets of the Detroit Reamer and Tool Co., formerly of West Congress Street, Detroit, Mich. The machinery and tools will be added to the equipment of the Ampco Twist Drill and Tool Co.

The West Sales Co., 1013 Ford Bldg., Detroit, Mich., will in the future be known as the West Tool Co., with offices at the same address. There will be no change in the organization.

The American Ship Building Company for the year ended June 30, 1922, reports total income of $1,585,182 before taxes and charges.

The Liquid Steel Welding Corporation, 401 West 23d St., Kansas City, Mo., has been organized by Anton Lucas, formerly with the Metal and Thermit Corporation, and will manufacture materials and appliances for welding, and welding compounds.

Lewis & Osborne, 713 Ohio Street, Wichita, Kan., have opened a new machine shop for general machine work and welding, and will install new equipment.

The Cutler Hammer Manufacturing Co., manufacturer of electric motor controllers, clutches, brakes, and other electrical equipment, New York City, announces the opening of a branch office in Buffalo, N. Y., 358 Ellicott Square, for the purpose of covering the territory of Western New York and the Province of Ontario, Canada. B. A. Hansen, formerly located in New York, has been placed in charge.

The Bridgeport Brass Co., Bridgeport, Conn., announces the opening of a Detroit office in the General Motors Building, Detroit, with Frank H. Longyear as district manager.

The Westinghouse Electric and Manufacturing Co. announces the following changes in its New York and Buffalo offices: C. W. Underwood, manager of the Buffalo office, has been appointed northern representative, with offices in Buffalo. The territory of the Buffalo office has been united with that of the New York office and A. E. Allen, manager of the New York office, will have charge of the Buffalo office also. Other changes, affecting these two offices, include the appointments of W. R. Marshall as branch manager of the Buffalo office; of E. W. Loomis as manager of the industrial division of the New York office; of W. A. Rossell as special power representative of the combined districts and of G. T. Dunklin as manager of the merchandising division of the New York office. The supply and power divisions of the New York office have been merged into the central station division under C. E. Stephens, manager, and the present railway division will in the future be known as the transportation division.

The Wilde Drop Forge and Tool Co., Kansas City, Mo., has filed incorporation papers with the secretary of State, Kansas, showing a capital stock of $50,000 and 1,000 shares of no par value. The company will manufacture, buy and sell tools, machinery of various kinds, act as manufacturer's agents and brokers. The shareholders are Mary Wilde, Goldie Wilde and Paul Froeschl.

The Porter-Cable Machine Co., Syracuse, N. Y., has purchased the Syracuse Sander Manufacturing Co., manufacturer of disc, oscillating spindle and belt sanders, and expects to move the business into the former's plant.

Personals

NEAL W. FOSTER, who has been acting manager of the National Acme Co., Windsor division, since the retirement of Mr. Gridley, has been appointed general manager to succeed Mr. Gridley and will have full charge of the Windsor plant.

DANIEL H. PARKER, who has been at the head of the purchasing department of the National Acme Co., Windsor division, has been appointed office manager of the Windsor plant.

TIMOTHY BYRNES has just been appointed general manager of the Lackawanna plant of the Bethlehem Steel Corporation.

ANTON LUCAS, for the past twenty-five years associated with the Goldschmidt Thermit Co., and its successor, the Metal and Thermit Corporation, has resigned and organized the Liquid Steel Welding Corporation, 401 West 23rd Street, Kansas City, Mo., of which company he will be general manager.

OLIVER L. HENN, formerly superintendent of the Windsor plant of the National Acme Co., has been appointed works manager.

BERT N. GREENWOOD, formerly with the Greenfield Tap and Die Corporation and with their predecessor in the manufacture of Greenfield grinders, the Greenfield Machine Co., has joined the sales force of Russell, Holbrook & Henderson, Inc., and will be stationed at Bridgeport, Conn.

KEITH J. EVANS, advertising manager of Jos. T. Ryerson & Son, Chicago, and Miss Harriet S. Guthrie were married in Riverside, Ill., on October 7.

J. F. GEARY, recently superintendent for the Niagara Radiator Co., North Tonawanda, N. Y., and previously in charge of various plants of the United States Radiator Corporation and American Radiator Co., is now district manager in western New York, Ontario and northwestern Pennsylvania for the Business Training Corporation of New York, specialists in training courses in production methods for foremen and production executives.

STANLEY T. GOSS, until recently vice president and sales manager of the New Britain Machine Co., has joined the staff of A. L. DeLeeuw, consulting engineer, as business manager.

E. E. HOFFMAN, of New York, has been appointed plant engineer of the Hendee Manufacturing Co., motorcycle producers, Springfield, Mass. He will have supervision of product design, tools and tool design, maintenance, inspection, material specifications and standardization.

C. H. SAWYER, formerly Rochester manager for the Syracuse Supply Co., and later connected with its Syracuse office, has taken charge of the Syracuse office of D. R. Clarkson and Co., Machine Tool Dealers, of Rochester.

COL. C. L'H. RUGGLES, the head of the technical division of the Ordnance Department, is acting as chief of Ordnance during the absence of Gen. C. O. Williams.

Obituary

FREDERICK E. ANTHONY, who for many years was in charge of the automatic screw machine tool designing at the Brown & Sharpe Manufacturing Co., died October 8, on his fifty-eighth birthday. Mr. Anthony was born in East Providence, and at the age of seventeen entered Brown & Sharpe's employ as an apprentice. He remained with the company until January, 1890, after which he worked with the Eastman Kodak Company and with Bugbee & Niles, of North Attleboro. In October, 1898, he again returned to the employ of the company, where he remained up to the time of his death. He represented the type of a trained mechanic which has made so much for the progress of mechanical lines in this country. He was fertile in devising ways and means of doing work, and his sound mechanical judgment and training kept him from various pitfalls that are so apt to embarrass a mechanical genius. Through his advice and experience, many of the details of the automatic screw machines were brought out.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering machinery and machine-tool lines—Belgium and France. Agency desired by a Belgian engineer now in the United States. Reference No. 3814.

Structural steel, window panes, plumbing equipment, light hardware, and bricks and plaster for a municipal building—Mexico. Correspondence should be in Spanish. Reference No. 3815.

Printing types and printing presses—India. Purchase is desired. Reference No. 3824.

Sheet aluminum for the manufacture of kitchen utensils—Italy. Purchase desired. Quotations, c.i.f. Italian port. Reference No. 3834.

Machinery and engineering supplies—New Zealand. Purchase and agency desired. Quotations, c.i.f. Australasian ports. Reference No. 3840.

Machinery for the manufactuer of glue, including equipment for solidifying and cutting gelatin, vacuum tanks, and dryers —Chile. Purchase desired. Quotations, c.i.f. Valparaiso. Reference No. 3841.

Small motor-driven irrigation pumps for farms, larger pumps for deep wells, and small centrifugal pumps—Greece. Purchase desired. Quotations, f.o.b. New York. Reference No. 3822.

Olive oil refining plant complete—Spain. Purchase desired. Quotations, c.i.f. Spanish port. Correspondence, Spanish. Reference No. 3842.

Popcorn machines—Mexico. Purchase desired. Catalogues and prices are requested. Reference No. 3843.

Machinery for distilling fruit essences—India. Purchase and agency desired. Quotations, c.i.f. Bombay. Terms, payment against documents. Reference No. 3844.

Carborundum powder—Japan. Purchase desired. Samples and prices are requested. Reference No. 3847.

Hardware, such as wood screws, wire nails, rose nails, bolts and nuts, rivets, files, and tool steel; cotton-mill stores; electrical goods and accessories; all kinds of tin and wooden ware; mechanical toys—India. Agency desired. Reference No. 3863.

Glassware, enamel and aluminum ware, lamp ware, safes, cutlery, hardware, rice mills and machinery, and sundries—India. Purchase desired. Terms, payment against documents. Reference No. 3870.

Wire, screws and hinges for bed springs —Spain. Purchase desired. Quotations, f.o.b. New York. Correspondence, Spanish. Reference No. 3873.

Machines for the preparation of popcorn for confections—Belgium. Agency desired. Reference No. 3879.

Galvanized chains for vessels; and pulp-machine wires—Norway. Agency desired. Quotations, f.o.b. New York. Payment to be arranged through Norwegian bank. Reference No. 3880.

Steel tubes, fittings, valves, and all similar steel and iron products—Netherlands. Agency desired from manufacturers. Quotations, f.o.b. American port. Payment, cash against documents. Reference No. 3893.

Trade Catalogs

Condensed Catalog of Mechanical Equipment. Issued by the American Society of mechanical Engineers. The catalog is now 9 x 12 in., the size of *Mechanical Engineering*, and is bound in limp covers. It contains 622 pages on thin paper and includes a general classified directory as well as a directory of consulting engineers.

Books on Practical and Radio Subjects. The Norman W. Henley Publishing Co., 2 West 45th St., New York City. This company has just issued for free distribution a new catalog of their practical books on various subjects, including their latest publications on Radio matters.

Centrifugal Pumps. The Coeur d'Alene Hardware and Foundry Co., Wallace, Idaho. A new publication, known as Bulletin No. 21, has just been issued by this company. It contains a complete description with detailed illustrations of the company's line of single stage, single suction volute centrifugal pumps for slime, sand and water. The bulletin also contains several useful tables on hydraulics.

Friction Clutches and Transmission Equipment. McMahon & Co., Worcester, Mass. An illustrated bulletin covering the various types of friction clutches, countershafts and pulleys manufactured by this company.

Nitrol. The American Kreuger and Toll Corporation, 522 Fifth Ave., New York City. This company has recently issued a new folder on the subject of nitrol, a hardening agent for iron and steel. The folder gives a full description of the product with numerous micro-photographs showing the effect of the agent on steel under varying conditions.

Automatic Regulators. Charles Engelhard, Inc., 30 Church St., New York City. A new publication known as Bulletin 24, of catalog P-3 containing fourteen pages has just been issued by this company. The publication contains complete descriptive matter with illustrations on the various types of thermo electric pyrometers, electric resistance thermometers, regulating units, etc., made by this company.

Motor Grinders and Buffs. The J. G. Blount Co., Everett, Mass. A booklet containing complete information regarding the numerous types and sizes of motor grinders and motor buffs produced by this company.

Pamphlets Received

Economic Development of Shantung Province, China. Trade information bulletin No. 70 of the Department of Commerce on the economic conditions in Shantung province, transmitted by the American Consul at Tsinau. Distributed by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

International Association of Public Employment Services. Bulletin No. 311, of the Bureau of Labor Statistics, Department of Labor, containing the proceedings of the ninth annual meeting of the International Association of Public Employment Services, held at Buffalo, N. Y., September 7 to 9, 1921.

Digest of Patent Laws of the World. The Midas Trade Mark and Patent Bureau, Ellsworth Building, Chicago, Ill. This bureau has just issued a new folder, known as Bulletin No. 106, containing a digest of the patent laws of the world. In concise form, information is contained on such matters as duration, proper applicant, filing limitation, tax periods and patent workings in every country. There is also presented a graphic chart of U. S. patent procedure.

Sampling and Analysis of Pig Iron. The Carnegie Steel Co., Bureau of Technical Instruction, Pittsburg, Pa. This company has just issued a 40-page pamphlet covering the methods employed by the chemists of the U. S. Steel Corporation for the sampling and analysis of pig iron. The publication, one of a series of seven thus far issued by the Bureau, contains a complete description of the various methods of procedure followed in the determination of the various constituents of pig iron. A circular of information regarding this pamphlet, as well as the other six publications on kindred subjects, may be had on application to the Bureau of Technical Information, Carnegie Steel Co., Pittsburg, Pa.

Forthcoming Meetings

National Hardware Association of the United States. Convention, Atlantic City, N. J. Oct. 17, 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. T. James Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa.

American Hardware Manufacturers' Association. Convention, Atlantic City, N. J., Oct. 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Tin quoted at 34¼c. as against 33c.; zinc sheets, 9½c. advanced from 9¼c. and solder (½ and ½) 25½c. as compared with 25c. per lb., one week ago, in New York warehouses. Lead, 6.3c. as against 6¼c. in East St. Louis. Increasing demand for tin plates; price tendency upward. Aluminum ingots up 2c. in Cleveland; babbitt metal also advanced, 1¼c.@1¾c. per lb. Zinc showing upward trend. Linseed oil prices firm; tending upward.

Declines—Structural shapes and soft steel bars, $2.15@$2.25 f.o.b. Pittsburgh, on ordinary tonnages; $1.90@$2, however, quoted on large orders. Plates, $2@$2.15; with undesirable specifications at a minimum of $2.25 per 100 lb. Substantial increase in discounts on rubber and duck belting, in New York warehouses. No. 2 foundry pig iron down $3 in Philadelphia and $1 in Pittsburgh; basic declined $2.50 per ton in Philadelphia.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	28.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	37.17
Basic	29.50
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	34.00
Basic	33.00
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	9.0	6 0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel BUTT WELD Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	68	56½	⅜ to 1½	34	19
LAP WELD					
2	61	49½	2	29	15
2½ to 6	65	53½	2½ to 4	32½	19
7 to 8	62	49½	4½ to 6	32½	19
9 to 12	61	48½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	⅜ to 1½	34	20
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	30	17
2½ to 4	63	52½	2½ to 4	33	21
4½ to 6	62	51½	4½ to 6	32	20
7 to 8	58	45½	7 to 8	25	13
9 to 12	52	39½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
5/0	8.00		12@13
¼	6.50		11@12
5/16 to ½	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			14.75
Tin, 5-ton lots, New York			34.25
Lead (up to carlots), St. Louis 6.30; New York			6.75@6.87½
Zinc (up to carlots), St. Louis 6.65; New York			7.37½
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.50	10.25	.....
Solder (½ and ½), (caselots)	25.50	23.50	20.00
Babbitt metal (83% tin)	34.00	44.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	3.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	12.00@12.50	
Coke, prompt foundry, Connellsville	per net ton	13.50@14.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1½ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅝-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—G. W. Kaull, 2134 Clark St., (machine shop)—forced feed rolling machine.

Ill., Chicago—J. H. Kruse, 2012 Chase Ave.—Hartley Universal coiling machine for machine shop.

Me., Portland—The Wright Moses Motor Co., 122 High St.—equipment for proposed garage on Forest Ave.

Mass., East Milton—Wadsworth & Jones, Adams St.—tools and equipment for proposed garage.

Mass., Somerville—Somerville Sales & Service Co., Highland and Willow Aves.—machinery, tools and equipment for proposed garage.

Mich., Iron River—Lindwall & Lindstrom (garage—repair shop machinery, including drill press and also air tanks.

Minn., Minneapolis—City Water Dept., City Hall, K. E. Alexander, City Purch. Agt.—will receive bids in about a month for one metal lathe for repair work, one small circular saw for carpenter, one power hammer, one drill press and grinding apparatus for proposed shop building.

Mo., Joplin—The Norton Taxicab Co., 520 Wall St., V. Norton, Purch. Agt.—complete garage machine shop equipment.

Mo., St. Louis—Schmidt Bros., 4371 Laclede St., (machine shop)—electric drill.

N. J., Garfield—De Matia Bros.—small radial drill press, between 3 and 3½ ft.

N. Y., Brooklyn—S. O. S. Welding Corp., 235 6th St.—one 8 ft. horizontal plate bending roll, and one small traveling crane.

N. Y., Buffalo—G. C. Kline, 2257 Niagara St.—small tools, etc., for addition to automobile repair shop.

N. Y., Buffalo—H. Knauss, 60 Saratoga St.—machinery and equipment for proposed 1 story garage and repair shop.

N. Y., Dunkirk—J. A. Wolpert, 210 Main St.—machinery, tools and equipment for garage and repair shop, to replace that which was recently destroyed by fire.

N. Y., Rochester—The Rochester Taxicab Co., 195 St. Paul St.—machinery, tools and equipment for $75,000 garage and service station.

N. Y., Rochester—C. F. Spies, 663 Winton Rd.—small tools, accessories, etc., for gas and service station at 669 Winton Rd.

O., Canton—The National Pressed Gear Co., 222 Cleveland Ave.—additional machinery for drop forged gear plant.

O., Cincinnati—The G. C. Dom Supply Co., 125 East Pearl St.—30 in. foot power tinners squaring shears.

Ore., Portland—R. S. Hughson, 10th and Couch Sts.—one machine turret lathe, 11 to 13 in. swing, with accessories and tools; 6 large size liquid fire extinguishers; one tool post grinder; one oxy-acetylene welding outfit.

Pa., Centerville—L. D. and L. L. Saunders—machinery, tools and equipment for proposed garage and service station.

Pa., Phila.—A. F. Hendricks Co., 907 Locust St., (sheet metal manufacturing products)—metal working machines.

Pa., Phila.—Humphrey & Co., Front St. and Tusculum Ave.—punches, shears, drills, etc., for steel plant.

Pa., Phila.—H. F. Munro, 1737 North 5th St., (sheet iron and metal products)—drill presses, punches, riveting machines, shears, etc.

Pa., Phila.—Pennsylvania R.R., Broad St. Sta., M. Smith, Purch. Agt.—one journal and axel lathe.

Pa., Pittsburgh—The Carnegie Steel Co., Carnegie Bldg.—drill press, pipe machines, grinder and woodworking machinery for new byproduct plant.

Pa., Pittsburgh—The Du Roth Steel Truck & Car Wheel Co., Keystone Bldg., A. Du Roth, Purch. Agt.—one 10 ton, one 5 ton and one 2 ton crane, also chain blocks, belting, shafting, lathes and presses.

Pa., Williamsport — S. T. McCormick, 3rd, 313-315 Hepburn St.—machinery, tools and equipment for $23,000 garage.

Tex., Electra—Magnolia Petroleum Co. (petroleum refiners)—machine shop equipment.

Wis., Appleton—Outagamie County, Court House, A. G. Brusewitz, Chn.—one 16 in. x 8 ft. lathe equipped for thread cutting, taper attachments, backing off attachments and straight tool holder; one Dunmore grinder for use on lathe; one milling machine equipped with arbor, vise and dividing head; one shaper; one small high speed drill press; one drill press for paper shank equipped with check to take up to ½ in. straight shank drills; one large emery stand; one 10 ton traveling crane; one 5 gal. gas pump and 800 gal. tank; five 120 gal. oil storage tanks, complete with pumps, barrel rake and chain hoist.

Wis., Burlington—J. A. Alby & Son Co., (garage)—power saw, lathe, gasoline storage tanks and pump.

Wis., Eau Claire—Garton Bros. Co., 227 Chestnut St., E. F. Garton, Mgr.—automobile repair machinery.

Wis., Madison—W. Mead, 201 Science Hall—one lathe, motor driven.

Wis., Milwaukee—Pabst Corp., 917 Chestnut St., H. W. Marsh, Secy.—nipple cutting and threading machines for the manufacture of nipples for galvanized iron pipe.

Wis., Rhinelander—J. Segerstrom & Co., (garage)—automobile repair machinery.

Wis., Sarona—A. J. Henderson—garage and blacksmith shop equipment to replace that which was destroyed by fire.

Machinery Wanted

Ala., Gadsen — Bd. Educ. — vocational equipment for proposed $200,000 high school.

Calif., San Francisco—H. Wolger, 2222 Fillmore St., (cabinet maker)—trim saw and jointer for power equipment.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer of the Panama Canal, Wash., D. C., receiving bids until Nov. 2, for steel, rivets, bolts, nails, section cars, mowing machines, brass sheets and tubing, copper tubing, boiler tubes, pig tin, valves, etc.

Ind., Indianapolis—Gem Laundry Co., 241 Indiana Ave.—machinery and equipment for $40,000 addition to laundry.

Ia., Dubuque—Bd. Educ., 245 B. and I. Bldg., L. Palen, Secy.—wood working machinery, including band saw, circle saw, mortiser, etc., for manual training department.

Kan., Wichita—C. F. Lewis, 713 Ohio St. (machine shop)—welding outfit, air compressor, emery stand, wheel, electric motor, belting, shafting and hangers.

Ky., Ashland—S. S. Willis—machinery and equipment for proposed brick plant at Summit.

Ky., Louisville—The Pyne Co., 927 Shelby Parkway—power punch and T. and L. pulleys.

Ky., Russellville—Independence Nitro Co.—complete machinery and equipment for proposed plant for the manufacture of nitroglycerin, capacity 800 qts. per day.

Ky., Whick—Noble Coal & Lumber Co., G. Noble, Pres.—electrical and mechanical mining equipment for mines.

Ky., Williamsburg—The Iroquois Natural Gas Co.—machinery and equipment for proposed plant for the manufacture of carbon black.

Md., Baltimore — D. C. Elpinstone, 408 Continental Bldg.—one electric locomotive crane suitable for handling a 2 cu. yd. bucket.

Mass., Brighton (Boston P. O.)—Cambridge Cement Stone Co., 156 Lincoln St.—concrete block machinery, also miscellaneous tools for repairs.

Mass., Fairhaven—The Atlas Tack Co.—Complete equipment for proposed tack manufacturing plant at St. Louis, Mo.

Mass., Natick—Natick Box Co., C. A. Coombs, Owner—woodworking and box making machinery of various kinds.

Mass., Somerville—Hoghosian Bros., 19 Simpson Ave.—machinery for candy factory.

Mich., Marshall—The Chronicle—printing press.

Mich., Republic—Cleveland Cliffs Iron Co.—blacksmith shop equipment.

Minn., Minneapolis—The Pillsburg Milling Co., 302 Metropolitan Life Bldg., A. C. Loring, Pres.—machinery, including conveying and handling machinery, for proposed $2,500,000 flour mill at Buffalo, N. Y.

Minn., Morris—The City, F. J. Haight, Mgr. of Waterworks—crane for pump station.

Miss., Jackson—The Clarion Ledger—model K linotype.

Mo., Joplin—The Carlson Printing Co., 618 Joplin St., A. C. Carlson, Purch. Agt.—complete job printing equipment, including job presses, belting, hangers, pulleys and bearings.

Mo., St. Louis—Pevely Dairy Co., 1001 South Grand St.—paper cutter with 26 in. blade.

Mo., St. Louis—The Rebstock Co., 1439 North 19th St.—conveyors, gravity rollers, belting, belt and collar conveyors.

N. Y., Binghamton—The Nineteen Hundred Washer Co., 205 Clinton St., (manufacturer of washing machines), P. J. Bickel, Secy.—additional machinery for proposed increase in output.

N. Y., Bowmansville—The Bowmansville Creamery, Inc., A. Snell, Purch. Agt.—equipment for refrigerating and creamery plant.

N. Y., Brooklyn—H. J. Wheeler Salvage Co., 224 Bush St.—low pressure compression cylinder, not less than 24 in. nor more than 36 in.

N. Y., Buffalo—Automatic Gear Co., 712 Erie County Bank Bldg., F. E. Freedman, Purch. Agt.—machinery for the manufacture of gears.

N. Y., Buffalo—The Eagle Bottling Wks., 415 Sycamore St., H. Cohen, Purch. Agt.—equipment for the manufacture of beverages.

N. Y., Buffalo—N. B. Fails Lubrication Co., 103 Manitoba St., N. B. Fails, Genl. Mgr.—three 12,000 gal. capacity each, gasoline and kerosene storage tanks, to be of ⅞ and ¼ in. metal, suitable for mounting upon wooden standards.

N. Y., Buffalo—The Gebhard Paper Co., 178 Ellicott St., A. Gebhard, Purch. Agt.—one 44 in. automatic paper cutter, one lever cutter and other printing equipment.

N. Y., Buffalo—P. J. Gunn, 80 Elk St.—machinery and equipment for battery service and engineering station.

N. Y., Buffalo—The Hall Paint Co., 143 Grape St.—equipment for the manufacture of paint.

N. Y., Buffalo—W. F. Hoffman, 23 Poplar St.—machinery and equipment for woodworking shop, including band saw, combination saw, lathe and cutoff saw.

N. Y., Buffalo—The Stabryte Steel Co., Inc., 8 Lord St., H. E. Bredemeier, Purch. Agt.—machinery for the manufacture of hardware and cutlery.

N. Y., Corning—Corning Hospital—mechanical and laundry equipment for proposed laundry.

N. Y., Jamestown — The International Casement Co., 84 Hopkins Ave., (manufacturer of steel window frames, etc.)—additional machinery for addition to factory.

N. Y., Jamestown—Jamestown Worsted Mills Co., 335 Harrison St.—machinery and equipment for proposed 1 and 2 story addition to mills.

N. Y., Jamestown — Watson Mfg. Co., Taylor St., (manufacturer of steel window and door screens)—additional machinery for four story addition to factory.

N. Y., Lockport—The Harrison Radiator Co., Washburn St.—machinery and equipment for proposed 3 story addition to radiator factory.

N. Y., New York—Acme Lighting Fixture Co., 107 West 13th St.—plating tank.

N. Y., New York—M. Buschbaum, 15 Park Row—Mayo knitting machines, 16 or 17 needles.

N. Y., New York—A. Loewy, 200 5th Ave., (machinery)—baling machine.

N. Y., Perry—The Fanning Co., Inc., (ice manufacturers) — refrigeration machinery and equipment for proposed 1,800 ton ice plant.

N. Y., Poughkeepsie—The Central Hudson Gas & Electric Co., 50 Market St.—small grinding outfit which will operate on ordinary lamp socket.

N. Y., Spencerport—J. E. Hay—one hand soleing machine and one stitching machine.

O., Akron—Rauschenberger Tire Co.—rubber working machinery for its auto tire factory at Granville, Wis.

O., Cleveland—Merit Motor Co., East 65th and Cedar Sts., (manufacturers of automobiles)—machinery and equipment for proposed plant at Niagara Falls, Ont.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts.—$10,000 worth of special ice machinery, electrically driven.

O., Lancaster—The Fairfield Eng. Co.—machinery and equipment for the manufacture of coal loading machinery, to replace that which was destroyed by fire.

O., Sebring—The Crescent China Co.—machinery and equipment for china ware manufacturing plant, including jigger shop, coal loading plant, kilns, etc.

O., Warren—H. W. Ward, North Mahoning Ave., (greenhouses) one large power driven feed cutting machine.

Okla., Eufaula—F. M. Billings—one 2 page, 7 column cylinder press for newspaper work.

Okla., Ponca City—Bd. Educ.—vocational equipment for proposed $200,000 high school.

Pa., Boyertown — Eastern Fdry. Co.—equipment for 1 and 2 story foundries.

Pa., Johnstown—Bd. Educ.—machinery for vocational department of proposed high school.

Pa., Lancaster — Fleck-Marshall Co., (manufacturer of plumbing supplies)—machinery and equipment for plant at Williamsport.

Pa., Marwood—Highland View Mfg. Co., (manufacturer of wood and metal specialties), J. Whewell, Pres.—machinery and tools, incl. hammers, nickel steel, etc., for proposed plant (under construction).

Pa., Phila.—Brehem & Stehle, Trenton and Allegheny Aves., (dyers) W. H. Brehem, Purch. Agt.—dryers, extractors, etc., for proposed dye plant.

Pa., Phila.—Dept. of Pub. Safety, 1328 Race St.—1 ton electric cable hoist.

Pa., Phila.—Dolfingers Standard Dairies, 16th and Tasker Sts.—refrigerating machines, sterilizers, bottle washing and filling machinery.

Pa., Phila.—G. J. Littlewood & Sons, Main St. and Walnut Lane, (dye and bleechers)—centrifugal dryers, extracators and other bleaching machinery.

Pa., Phila.—Roosevelt Worsted Mills, 2023 Naudain St., F. Quitner, Purch. Agt. Machinery for—looms, cards, combs, etc.

Pa., Phila.—M. L. Shoemaker & Co., Venango St. and Delaware Ave., (fertilizer manufacturers)—grinders, maceraters, etc., for plant.

Pa., Pittsburgh—H. J. Heinz, 1062 Progress St., N. S., (pickles and preserves)—one 2 ton crane.

Pa., Pittsburgh — Kund & Eiben Mfg. Co., 204 Warrington Ave., (cabinet makers)—woodworking machinery, direct driven from individual motors.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—one 60 ft. span 5 ton crane.

Pa., Pittsburgh—Pittsburgh Valve Fdry. & Constr. Co., Penn Ave.—one 5 ton crane.

Pa., Scranton—Nagelberg & Fiegenbaum, 1005 Capouse St.—machinery and equipment for clothing and underwear factory.

Pa., Warren—C. Hamm, 28 Clark St.—wood working machinery.

Pa., Warren—The Seneca Oil Wks., South Carver St.—machinery and equipment for proposed addition to refinery.

Pa., Williamsport—Williamsport Building Products Co., 1603 Erie Ave.—additional machinery and equipment for proposed building products factory.

Pa., York—Markel Hall Hosiery Mills—Scott & Williams knitting machines, Model B-5.

Tenn., Knoxville—The Appalachian Marble Co., Inc., P. O. Box 837—pumping outfit, prefer direct connected turbine set, capacity 50 gal. per minute against a head of 85 to 100 lb. gauge pressure.

Tenn., Memphis—Clover Farm Dairy Co., 789 Union Ave—$70.000 worth of modern machinery for creamery, dairy and ice cream factory.

Va., Richmond—J. W. Ferguson & Sons, 105 North 14th St., (printers)—one large Miehle press, folding machine and job presses.

Wash., Centralia—H. Staistedt, 412 North Diamond St.—one 150 to 200 lb. belt driven drop hammer.

W. Va., Wellsburg—The Hammond Bag & Paper Co., P. O. Box 467 — special bag machinery, hangers, pulleys, belting and shafting.

Wis., Algoma—Algoma Wood Products Co.—woodworking and special machinery, also power machinery.

Wis., Appleton—T. Heide, 635 Appleton St.—refrigerating machinery.

Wis., Madison—State Bd. of Control, Capitol, M. J. Tappins, Secy.—receiving bids until Oct. 24 for refrigerating machinery.

Wis., Merrill—Heineman Lumber Co., H. H. Heineman, Purch. Agt.—saw mill machinery, belting and shafting.

Wis., Milwaukee—Burleigh Hardware Co., c/o A. H. Butenhoff, 1400 28th St.—sheet metal working machinery, brake, etc.

Wis., Milwaukee—G. O. Dallmann, 375 Manitoba Ave., (woodwork)—circle saw with motor.

Wis., Milwaukee—W. A. Getzel, 1218 23rd Ave., (millwork)—trim saw.

Wis., Milwaukee—J. Jazwiecki, 849 Lincoln Ave., (bakery)—mechanical bake oven, electrical mixers, etc.

Wis., Milwaukee—J. H. Marshutz, 1005 Trust Co. Bldg.—overhead crane.

Wis., Milwaukee—Terner Metal Specialty Co., c/o J. Eder, 606 Caswell Blk.—stamping machine.

Wis., Milwaukee—Waukesha Dairy Co., 342 6th St.—dairy and refrigeration machinery for proposed addition to plant.

Wis., Park Falls—The Flambeau Paper Co., G. Walds, Mgr.—power and pulp mill machinery.

Wis., Plymouth—The Badger Cabinet Co.—woodworking and special machinery for chair factory at Pulaski.

Wis., South Milwaukee—The Burnham Bros. Brick Co., 68 Wisconsin St.—crane for proposed dryer plant.

B. C., Vancouver — J. Read, c/o Bridge River Power Co., 602 Hastings St., W.—machinery and equipment for proposed large pulp and paper mill.

Ont., Brantford—Brantford Arena Co., A. Ballyntyne, Pres.—ice making equipment for proposed arena.

Ont., Galt—Stauffer-Dobbie, Ltd., (carpets)—"Royle" Jacquard cutting machine.

Ont., Humberstone—Humberstone Shoe Co. Ltd., H. H. Knoll, Purch. Agt.—two 4 in. gearless sole cutting machines, one 5 hp. electric motor, 1 clicking machine, 60 ft. of 1½ in. shafting with hanger couplings, wooden shoe racks, etc.

Ont., London—The Corrugated Carton proposed factory.

Ont., St. Thomas—W. A. McIntyre, Chn. City Gas Comn.—equipment for gas plant.

Ont., Weston—Moffats Ltd., F. W. Moffat, Purch. Agt.—equipment for porcelain enameling department.

Que., Pointe aux Trembles — Parlor Furniture Mfg. Co. Ltd., Victoria St., G. Langelier, Purch. Agt.—woodworking machinery to replace that which was destroyed by fire.

Metal Working Shops

Calif., Oakland — The Chevrolet Motor Co., Foothill Blvd. and 69th Ave., awarded the contract for the construction of a 2 story, 80 x 684 ft. factory on Hillside Ave. and 72nd St. Estimated cost $300,000. Noted Oct. 12.

Calif., San Francisco — J. Madison, 112 Market St., has had plans prepared for the construction of a 3 story factory, on Harrison St. near Langton St.. Estimated cost $29,950. N. Blaisdell, 255 California St., Archt. Pacific Meter Co., 1123 Harrisosn St., lessee.

Calif., San Francisco — J. Pasqualetti, 785 Market St., awarded the contract for the construction of a 2 story garage, on O'Farrell St. near Steiner St. Estimated cost $38,900. Noted July 20.

Conn., Bridgeport—The Atlas Body Wks., Inc., 147 McKinley Ave., awarded the contract for the construction of a 1 story, 76 x 90 ft. addition to its factory and a 1 story, 15 x 30 ft. power house. Estimated cost $25,000. Noted Sept. 14.

Conn., Danbury—The Ball & Roller Bearing Co., 22 Maple Ave., awarded the contract for the construction of a 2 story, 50 x 114 ft. addition to its factory, on Maple Ave. and Crosby Sts. Estimated cost $40,000.

Conn., Plantsville—The Blakeslee Forging Co. is having plans prepared for the construction of a 2 story, 40 x 42 ft. addition to its forge shop. Estimated cost $15,000. Greenwood & Noerr, 847 Main St., Engrs. and Archts.

Conn., Waterbury—The Plume & Atwood Mfg. Co., 470 Bank St., manufacturer of brass goods, awarded the contract for the construction of a 1 story, 27 x 30 ft. addition to its factory. Estimated cost $5,000.

D. C., Wash. — The Lambert Hudson Motor Co., 1212 Connecticut Ave., awarded the contract for the construction of a service station on 22nd and M Sts., N. W. Estimated cost $150,000. W. E. Lambert, Pres.

Ill., Chicago—Kocher & Larson, Archts., 6250 South Halsted St., are receiving bids for the construction of a 1 and 2 story, 36 x 146 ft. addition to factory, for the Advance Fdry. & Pattern Co., 2734 West 36th St. Estimated cost $50,000.

Ind., Indianapolis — The Conduitt Automobile Co., 314 North Delaware St., awarded the contract for the construction of a 3 story, 63 x 200 ft. automobile sales and service station, on North Meridian Ave. Estimated cost $150,000. Noted Sept. 7.

Me., Portland—Clough & Maxim, Fidelity Bldg., will build a 1 story, 55 x 200 ft. automobile service station on Forest Ave. Estimated cost $40,000. Poor & Thomas, Brown Bldg., Archts. The Wright Moses Motor Co., 122 High St., Lessees.

Mass., East Milton—Wadsworth & Jones, Adams St., plan to build a garage. Cost between $15,000 and $18,000.

Mass., Fall River—The Bd. of Water Comrs. awarded the contract for the construction of a 2 story, 30 x 145 ft. machine shop on Bedford St. Estimated cost $40,000.

Mass.,, Lawrence—The Champion-International Paper Co., 38 Prospect St., is having plans prepared for the construction of a 1 story, 65 x 115 ft. machine shop. Estimated cost $30,000. Private plans.

Mass., Roxbury (Boston P. O.)—J. J. Walsh Co., 1540 Columbus Ave., is receiving bids for the construction of a 2 story, 50 x 100 ft. addition to its automobile body factory. Estimated cost $24,000. S. J. Rantin, 1117 Columbus Ave., Archt.

Mo., St. Louis—The Atlas Tack Co., Fairhaven, Mass., awarded the contract for the construction of a tack manufacturing plant, consisting of a 1 story, 203 x 503 ft. main plant, a 2 story, 25 x 203 ft. office building, 30 x 67 ft. and 30 x 187 ft. storage sheds, and also a 20 x 30 ft. transformer house, on Union and Geraldine Sts., here. Estimated cost $400,000.

N. Y., Buffalo—The Birk-Notman Motor Co., Inc., 828 Main St., plans to build a 1 story, 50 x 150 ft. garage on Hertel and Delaware Aves. Estimated cost $40,000.

N. Y., Lockport—The Harrison Radiator Co., Washburn St., is having plans prepared for the construction of a 3 story, 150 x 300 ft. addition to its plant. J. R. Tyler, 715 Union Trust Bldg., Rochester, Archt.

N. Y., New York—A. Revere, c/o H. J. Nurick, Archt. and Engr., 44 Court St., Brooklyn, will soon receive bids for the construction of a 3 story, 75 x 100 ft. garage at 531 West 36th St. Estimated cost $75,000.

N. Y., New York—The Transit Comn., 49 Lafayette St., will receive bids until Oct. 20, for furnishing and erecting steel, and building foundation for third addition to its shops at Lenox Ave. and 148th St.

N. Y., Rochester—F. J. Zorn, 64 North Plymouth Ave., is receiving bids for the construction of a 2 story, 100 x 212 ft. and 58 x 182 ft. garage at 195 St. Paul St. Estimated cost $75,000. Foote & Carpenter, State and Church Sts., Archts.

N. Y., Springville—A. C. Fisher plans to build a 50 x 100 ft. machine shop. Cost will exceed $5,000.

O., Canton—The National Pressed Gear Co., Crane Bldg., awarded the contract for the construction of the first unit of its proposed factory, 1 story, 50 x 175 ft., on Allen Ave., S. E. Estimated cost $200,000.

O., Cleveland—The R. and L. Baker Co., c/o K. E. Stahl, 2180 West 25th St., awarded the contract for the construction of a 1 story, 36 x 48 ft. kiln and a 69 x 112 ft. addition to its factory, for the manufacture of automobiles. Estimated cost $60,000.

O., Cleveland—The Gabriel Mfg. Co., 1401 East 40th St., awarded the contract for the construction of a 2 story, 60 x 160 ft. addition to its factory, for the manufacture of auto accessories. Estimated cost $60,000. C. Foster, Mgr.

O., Columbus — The Lawwell-McLeish Co., 97 North 4th St., awarded the contract for the construction of a 2 story, 63 x 94 ft. garage. Estimated cost $17,875. Noted Aug. 17.

O., Lancaster—The Fairfield Eng. Co. plans to build a factory for the manufacture of coal loading machinery, to replace the one which was recently destroyed by fire. Estimated cost $250,000.

O., Newburg Heights (Cleveland P. O.)—The Aluminum Manufacturers, Inc., c/o O. Tessier, 2210 Harvard Ave., plans to build a 2 story, 50 x 100 ft. factory. Estimated cost $50,000. Private plans.

Pa., Altoona—The Pennsylvania R.R., Broad St. Sta., Phila., plans to build a 1 story erecting and machine auxiliary shops on 16th St., and will also convert present roundhouse into a locomotive repair shop. A. C. Shand, Broad St. Sta., Phila., Ch. Engr.

Pa., Butler—Rieck McJunkin Dairy Co., Forbes St., Pittsburgh, will build a 2 and 3 story top addition to its garage and warehouse, on McKean and East Wayne Sts. Estimated cost $60,000. A. Daniels, c/o owner, Archt. Noted July 6.

Pa., Clairton—The Carnegie Steel Co., Carnegie Bldg., Pittsburgh, awarded the contract for the construction of an addition to its byproduct plant, consisting of over 200 byproduct ovens with full equipment, here. Estimated cost $2,000,000.

Pa., Juniata—The Pennsylvania R.R., Broad St. Sta., Phila., is having plans prepared for the construction of 1 story, 100 x 700 ft. erecting and machine auxiliary shops, here. Estimated cost $300,000. W. H. Cookman, Broad St. Sta., Phila., Archt. A. C. Shand, Ch. Engr.

Pa., Phila.—W. Fleming, 956 Foulkrod St., awarded the contract for the construction of a 1 story, 32 x 60 ft. machine shop, on Cottman and G Sts.

Pa., Phila.—C. E. Wunder, Archt., 1415 Locust St., is receiving bids for the construction of a 2 story, 60 x 144 ft. steel factory on Van Dyke St. and Torresdale Ave., for Humphreys & Co., Front St. and Tusculum Ave.

Pa., Pittsburgh—The Commercial Land Co., c/o A. H. Byers, 235 Water St., awarded the contract for the construction of a 4 story garage and office building on Rebecca St. and Baum Blvd. Estimated cost $175,000. Noted Aug. 3.

Pa., Pittsburgh—The Hanlon Gregory Galvanizing Co., 24th St., awarded the contract for the construction of a 1 story, 100 x 400 ft. mill, on 56th and Butler Sts. Estimated cost $100,000. Noted Oct. 5.

Pa., Pittsburgh—R. W. Hinkle, 601 Foreland St., and Buettner Bros., 3271 East St., awarded the contract for the construction of a 1 story, 30 x 110 ft. garage, at 21 and 23 Foreland St. Estimated cost $40,000.

Pa., Vandergrift—McCutcheon Bros. are receiving bids for the construction of a 1 story, 70 x 130 ft. garage on Washington Ave. and 12th Alley. Estimated cost $40,000. G. M. Rowland, Bakewell Bldg., Pittsburgh, Archt. Blum, Weldin & Co., Bakewell Bldg., Pittsburgh, Engrs.

Pa., Washington—Hazel Atlas Glass Co., South Main St., will build a 3 story, 44 x 79 ft. machine shop. Estimated cost $50,000. L. Meharg, c/o owner, Engr.

Pa., Washington—L. Snyder awarded the contract for the construction of a 1 story, 44 x 65 ft. machine shop. Estimated cost $10,000.

Pa., Williamsport—The Fleck Marshall Co., Lancaster, has purchased the Rothfuss Howard Iron Wks., on East 3rd St., here, and plans to build a 2 story foundry and machine shop. J. Fleck, 50 North 5th St., Phila., Pres.

Pa., Williamsport — The Williamsport Wire Rope Co. awarded the contract for the construction of a 1 story, 80 x 142 ft. addition to its factory, for the manufacture of wire rope and similar products. Estimated cost $10,000.

W. Va., Fairmont—F. W. McIntire plans to build a 2 story, 50 x 160 ft. garage. Private plans.

W. Va., Huntington—R. L. Day, Archt., 1st Natl. Bank Bldg., is receiving bids for the construction of a 1 story, 108 x 201 ft. addition to stamping plant, for the Armstrong Mfg. Co.

Wis., Appleton—P. Rademacher, 801 Superior St., will build a 1 story, 32 x 120 ft. garage. Estimated cost $40,000. Private plans.

Wis., Burlington—J. Alby & Son, will build a 2 story, 30 x 80 ft. garage. Estimated cost $40,000. Noted Aug. 29.

Wis., Eau Claire—Garton Bros. Co., 227 Chestnut St., awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Madison St. Estimated cost $40,000. E. F. Garton, Mgr.

Wis., Kewaunee—The Leyse Aluminum Co. plans to build a 2 story, 75 x 160 ft. factory for the manufacture of aluminum products. A. B. Leyse, Pres. Architect not selected.

Wis., Kohler—Brust & Philipp, Archts., 405 Bway., Milwaukee, are receiving bids cost $200,000. Architect not announced.

for the construction of a 4 story, 70 x 160 ft. factory for the manufacture of plumbing fixtures, here, for Kohler Co. Estimated cost $75,000.

Wis, Madison—The University of Wisconsin plans to build a 1 story, 60 x 95 ft. machine shop, for use in the department of engineering, on Breeze Terrace. M. E. McCoffery, Secy. Architect not selected.

Wis., Marinette— C. Anderson & Sons, Cook and Merryman Sts., are having plans prepared for the construction of a 2 story, 50 x 75 ft. factory for the manufacture of brick conveyors. Estimated cost $75,000. Private plans.

Wis., West Bend—The Amer. Service & Storage Garage, c/o M. A. Johennes, is having plans prepared for the construction of a 2 story, 60 x 80 ft. garage. Estimated cost $40,000. L. Hunt, 445 Milwaukee St., Milwaukee, Archt.

Ont., Niagara Falls—The Cameron Motor Co., Cleveland, O., plans to build a branch factory, here.

Ont., Niagara Falls—D. W. Robert Mfg. Co., Lockport, N. Y., will receive bids about March 1 for the construction of a 1 story, 40 x 80 ft. factory, for the manufacture of knives for paper cutting, here. Estimated cost $5,000. Architect not announced.

Ont., Toronto — The Toronto Hardware Mfg. Co., 402 Dufferin St., plans to build a factory. Estimated cost $60,000. Architect not selected.

Ont., Weston—Moffatts Ltd. awarded the contract for the construction of a 2 story, 60 x 100 ft. addition to stove factory. Estimated cost $60,000.

General Manufacturing

Calif., Petaluma—B. Jones, Archt., Petaluma, is receiving bids for the construction of a packing plant, for the Poultry Producers of Central California, 323 East Washington St. Noted Oct. 5.

Calif., San Francisco — The Legallett-Heilwig-Norton Co., 1600 Fairfax Ave., awarded the contract for the construction of a 3 story, 50 x 105 ft. factory for tanning plant. Estimated cost $12,000.

Calif., San Francisco—C. E. Lewis, 306 Sacramento St., has had plans prepared for the construction of a 2 story, 25 x 120 ft. glove factory, on 6th St. near Folsom St. Estimated cost $6,500.

Calif., Taft—Cottage Laundry, 322 Main St., plans to build a 1 and 2 story laundry. Estimated cost $50,000. B. Mills, owner. Architect not selected.

Conn., Bridgeport — Fletcher-Thompson, Inc., Engrs. and Archts., 542 Fairfield Ave., are receiving bids for the construction of a 3 story, 60 x 110 ft. addition to ice cream plant, for the Huber Ice Cream Co., 800 Seaview Ave. Estimated cost $150,000.

Conn., East Lyme—The Niantic Mfg. Co. awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its woolen mill. Estimated cost $5,000.

D. C., Wash.—N. Auth Provision Co., 633 D St., awarded the contract for altering and building an addition to its plant. Estimated cost $74,950.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson Blvd., is receiving bids for the construction of a 3 story, 100 x 300 ft. candy factory, on Cicero and Kinzie Sts., for E. J. Brach & Sons, 215 West Ohio St. Estimated cost $1,000,000. Noted Sept. 14.

Ill., Chicago—The Bassick Mfg. Co., 2638 North Crawford Ave., is having plans prepared for the construction of a 1 story, 55 x 142 ft. factory for the manufacture of lubricating oils, on North Homan Ave. R. S. Ostergren, 155 North Clark St., Archt.

Ill., Chicago—The Valentine Seaver Co., 1721 Sedgewick St., awarded the contract for the construction of a 4 story, 103 x 171 x 272 ft. furniture factory, on Greenview and Wrightwood Sts. Estimated cost $400,000. Noted Oct. 12.

Ind., Borden—The Indiana Borden Cabinet Co. plans to build a 2 story addition to its furniture factory. Estimated cost $35,000. Architect not selected.

Ind., Indianapolis—The Enquirer Printing Co., 309 East Ohio St., awarded the contract for the construction of a 2 story, 55 x 93 ft. printing plant. Estimated cost $25,000. Noted Sept. 14.

Ind., Madison—The Pearl Packing Co. plans to build a 1 story, 56 x 129 ft. packing plant. Estimated cost $26,000. M. P. Burt Co., Falls Bldg., Memphis, Tenn., Engr.

Ky., Williamsburg—The Iroquois Natural Gas Co. plans to build a large plant for the manufacture of carbon black. Estimated announced.

Mass., Cambridge—The Boston Woven Hose & Rubber Co., 15 State St., awarded the contract for the construction of a 1 story, 43 x 82 ft. factory. Estimated cost $20,000.

Mass., East Lee—The Mountain Mill Paper Co. will build a 2 story, 35 x 60 ft. addition to its mill.

Mass., Watertown — The Hood Rubber Co., Nichols Ave., will build a 1 story, 50 x 150 ft. addition to its vulcanizing plant. Estimated cost $7,500.

Mass., Watertown—Vose & Sons Piano Co., 1010 Massachusetts Ave., Roxbury, is having plans prepared for a piano factory on School and Arsenal Sts., here. Estimated cost $300,000. Densmore & LeClear, 88 Broad St., Boston, Archts.

N. Y., Buffalo — The Pillsbury Milling Co., 302 Metropolitan Life Bldg., Minneapolis, Minn., will receive bids about March 1 for the construction of a large flour mill, capacity 7,000 bbl. per day, here. Estimated cost $2,500,000. A. C. Loring, Pres. Architect not announced.

N. Y., Jamestown — The Jamestown Lounge Co., 40 Winsor St., will build a 6 story, 102 x 144 ft. addition to its factory. Noted Oct. 12.

N. Y., Perry—The Fanning Co., Inc., has awarded the contract for the construction of an 1,800 ton ice plant.

N. Y., Yonkers—Alex Smith & Sons, Elm Ave., awarded the contract for the construction of a 4 story, 130 x 136 ft. spinning mill, a 2 story, 50 x 150 ft. yarn storage building, 1 story, 75 x 200 ft. waste storage building and 1 story, 30 x 60 ft. dye house. Estimated total cost $300,000.

O., Cleveland — The Excelsior Varnish Co., 1242 West 74th St., awarded the contract for the construction of a 2 story, 30 x 42 ft. factory. Estimated cost $25,000. J. C. Vick, Mgr.

O., Cleveland—The Mechanical Rubber Co., c/o A. C. Kingston, Mgr., foot of Lisbon Rd., awarded the contract for the construction of a 3 story, 40 x 50 ft. factory. Estimated cost $40,000.

O., Cleveland — The Whitmer-Jackson Sash & Door Co., 1996 West 3rd St., has had plans prepared for the construction of a 2 story, 70 x 151 ft. addition to its lumber mill. Estimated cost $40,000. S. H. Whitmer, Pres. H. M. Morse, Finance Bldg., Archt.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts., is having plans prepared for a 2 story ice factory on West Broad St. Estimated cost $20,000. Bassett & Tressell, Citizen's Bank Bldg., Archts.

Pa., Jacobs Creek—The United States of America Drug & Chemical Co. is receiving bids for the construction of a 3 story, 72 x 120 ft. drug and chemical factory. Estimated cost $150,000. P. Rossello, 406 Congress Bldg., Detroit, Mich., Archt.

Pa., Kane—The Sakura Soap Co., will build a 1 story, 45 x 126 ft. addition to its factory. E. A. Phillips, Warren Trust Bldg., Warren, Pa., Archt.

Pa., McKees Rocks — The Chesebrough Mfg. Co., 17 State St., New York City, awarded the contract for the construction of a 2 story, 106 x 143 x 190 x 195 ft. finishing building, a 1 and 2 story, 31 x 103 ft. tank house, and a 1 story, 36 x 39 ft. boiler house, here. Estimated cost $200,000. This is the first unit of proposed $1,000,000 manufacturing plant. Noted Oct. 5.

Pa., Oakmont—Mills, Rhines, Bellman & Nordhoff, Archts., 1234 Ohio Bldg., Toledo, O., are receiving bids for altering and constructing a 2 story, 74 x 94 x 157 x 158 ft. addition to paper bag factory, here, for the Valve Bag Co. of America, 3444 Summit Ave., Toledo, O.

Pa., Phila.—The Logan Ice Co., 10th and Windrim Sts., awarded the contract for the construction of a 1 story, 96 x 182 ft. ice manufacturing plant, consisting of 4 buildings.

Pa., Phila.—The Standard Provision Co., Callowhill and Willow Sts., awarded the contract for the construction of a 3 story, 70 x 160 ft. packing plant. Estimated cost $120,000. Noted Aug. 29.

Pa., Rossmere (Lancaster P. O.)—Rowe-Stuart Motors Corp. awarded the contract for the construction of a 1 story, 120 x 300 ft. factory, for the manufacture of special pneumatic tires and other rubber automobile goods.

Pa., Warren—C. Hamm, 28 Clark St., will build a 2 story, 35 x 120 ft. woodworking shop, to replace the one destroyed by fire.

Pa., Warren—The Seneca Oil Wks., South Carver St., plans to build a new cracking plant in connection with its refinery, for the manufacture of gasoline from low grade oil. Estimated cost $60,000. Architect not